FIG. 1

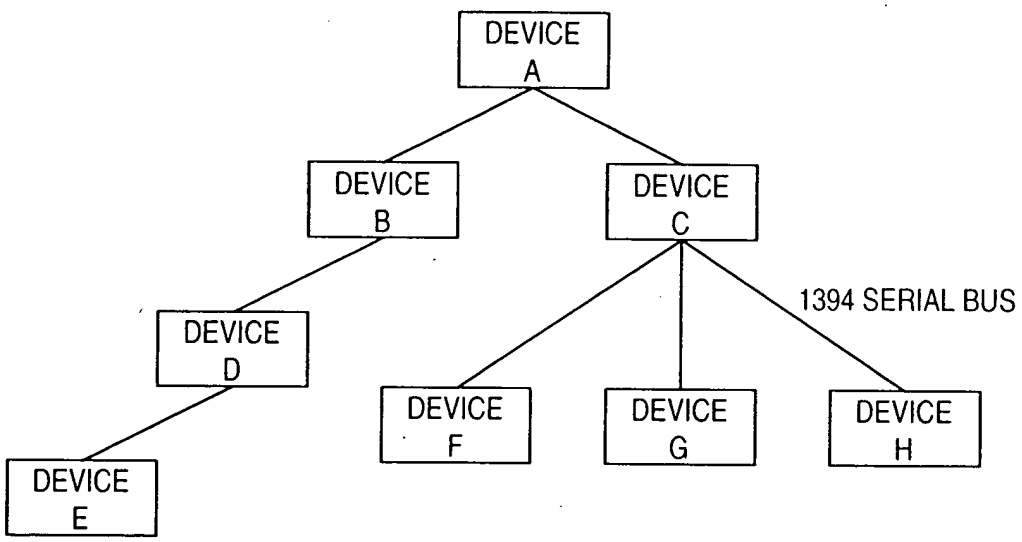

DEVICE A
DEVICE B
DEVICE C
DEVICE D
DEVICE E
DEVICE F
DEVICE G
DEVICE H
1394 SERIAL BUS

FIG. 2

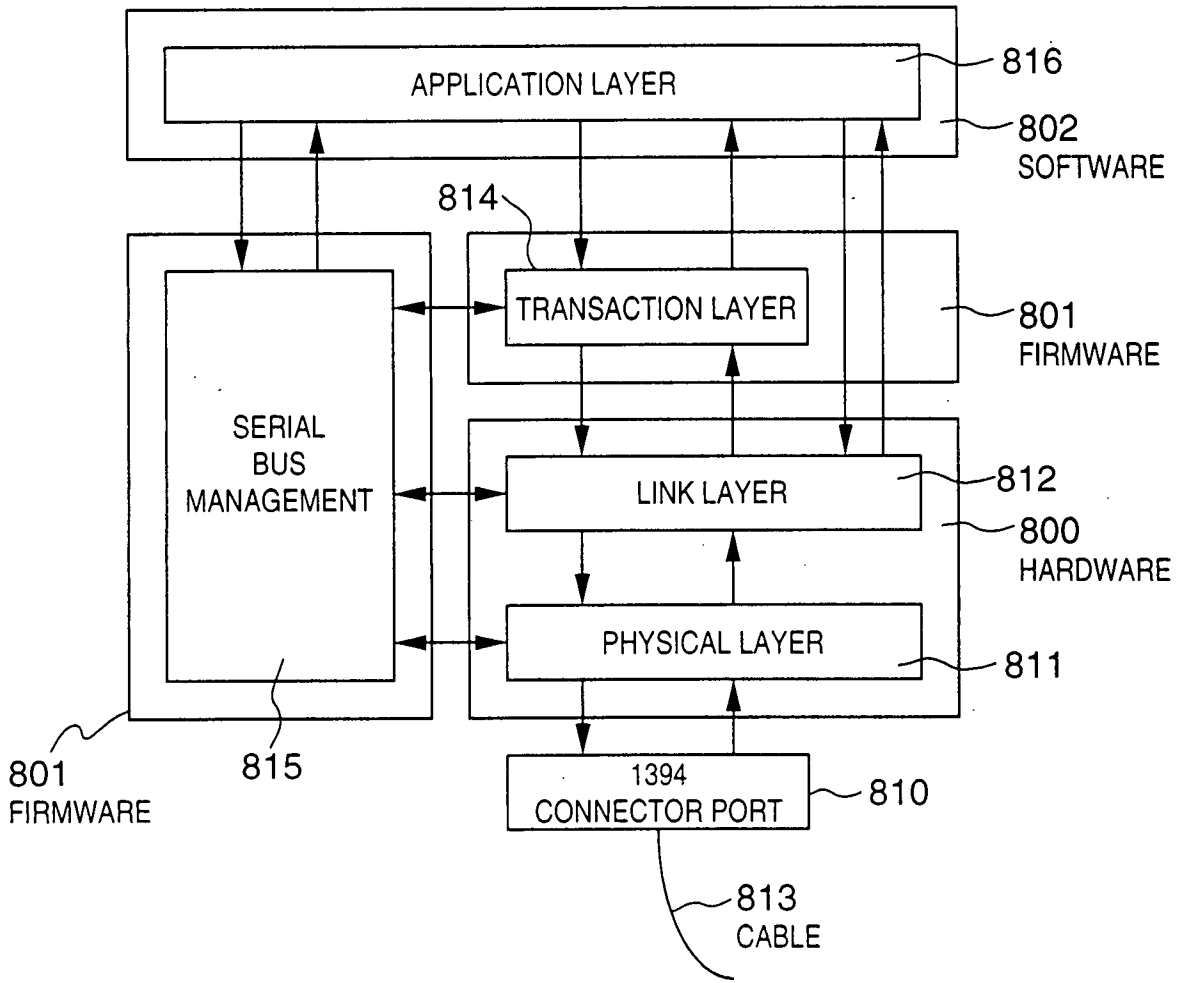

APPLICATION LAYER
816
802
SOFTWARE
814
TRANSACTION LAYER
801
FIRMWARE
SERIAL
BUS
MANAGEMENT
LINK LAYER
812
800
HARDWARE
PHYSICAL LAYER
811
801
FIRMWARE
815
1394
CONNECTOR PORT
810
813
CABLE

FIG. 3

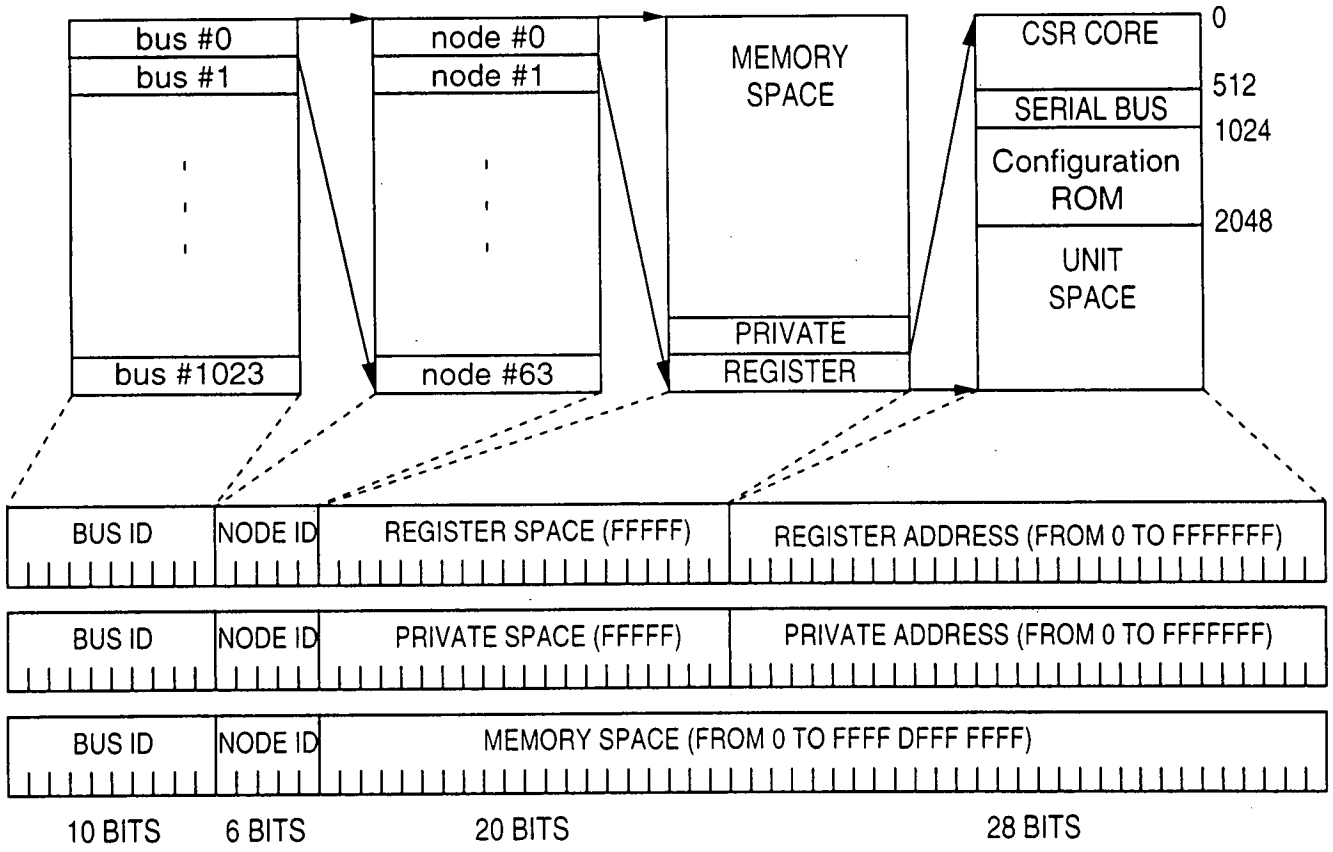

bus #0
bus #1
bus #1023
node #0
node #1
node #63
MEMORY SPACE
PRIVATE
REGISTER
CSR CORE
SERIAL BUS
Configuration ROM
UNIT SPACE
0
512
1024
2048
BUS ID
NODE ID
REGISTER SPACE (FFFFF)
REGISTER ADDRESS (FROM 0 TO FFFFFFF)
BUS ID
NODE ID
PRIVATE SPACE (FFFFF)
PRIVATE ADDRESS (FROM 0 TO FFFFFFF)
BUS ID
NODE ID
MEMORY SPACE (FROM 0 TO FFFF DFFF FFFF)
10 BITS
6 BITS
20 BITS
28 BITS

FIG. 4

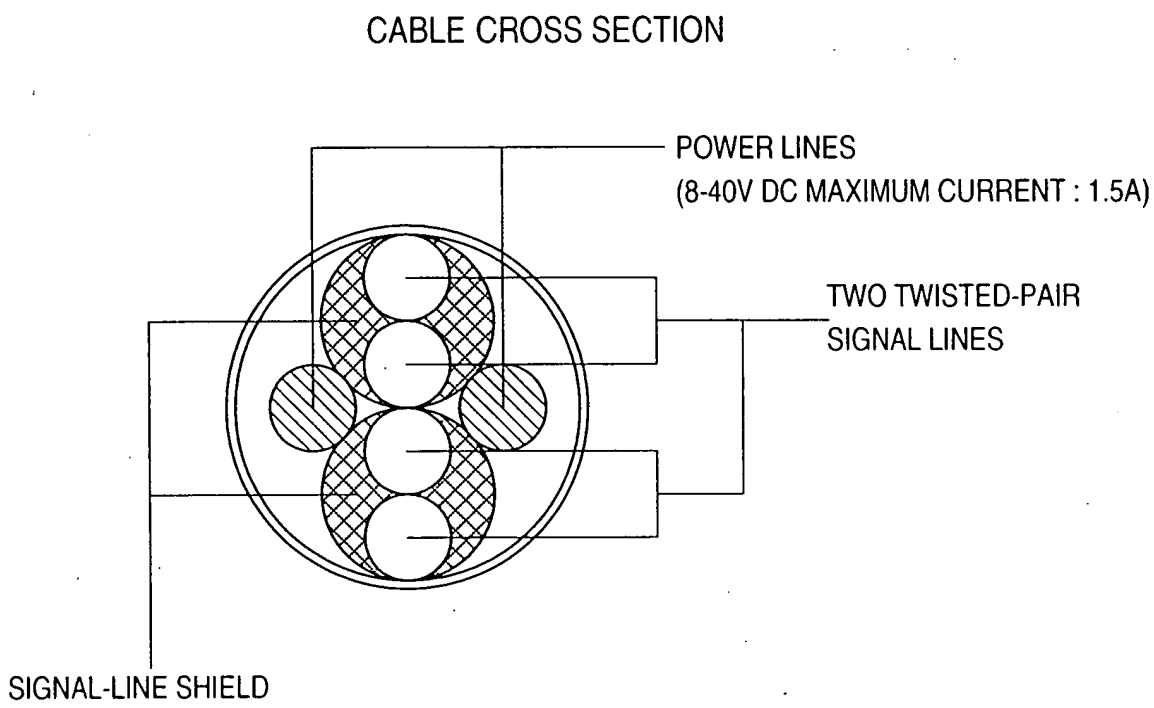

CABLE CROSS SECTION
POWER LINES
(8-40V DC MAXIMUM CURRENT : 1.5A)
TWO TWISTED-PAIR
SIGNAL LINES
SIGNAL-LINE SHIELD

FIG. 5

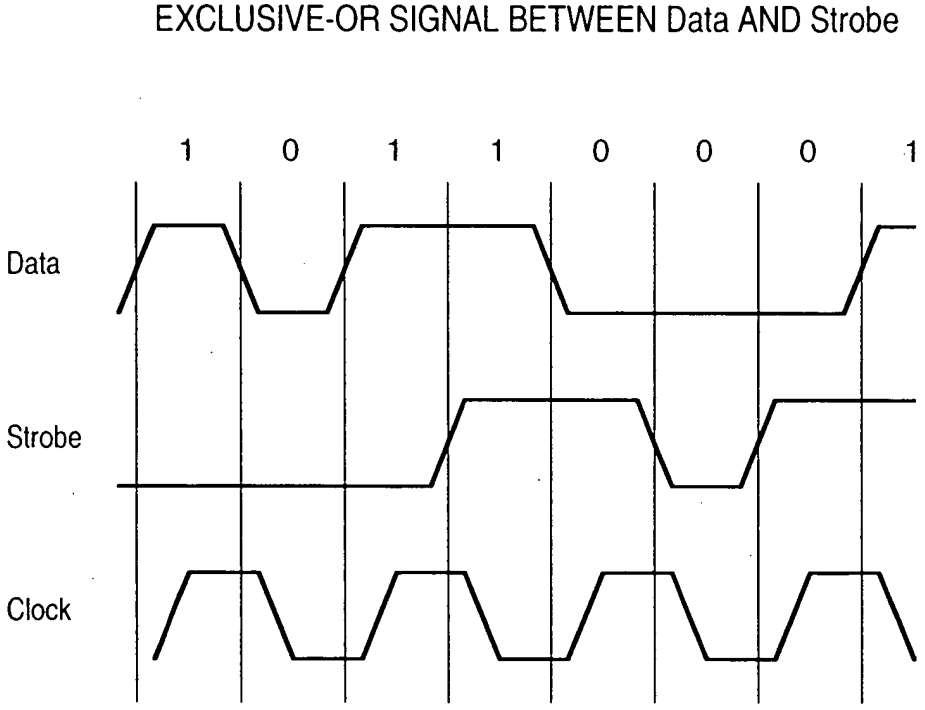

EXCLUSIVE-OR SIGNAL BETWEEN Data AND Strobe
1
0
1
1
0
0
0
1
Data
Strobe
Clock

FIG. 6

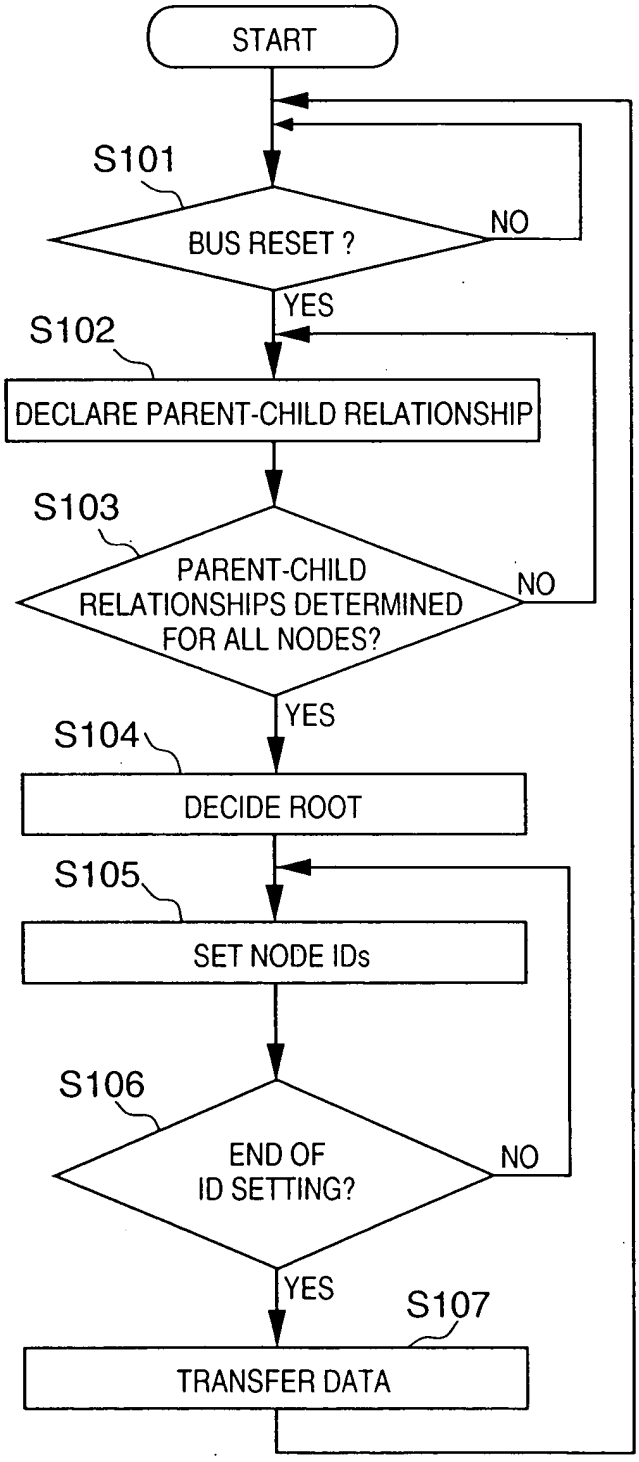

START
S101
BUS RESET ?
NO
YES
S102
DECLARE PARENT-CHILD RELATIONSHIP
S103
PARENT-CHILD RELATIONSHIPS DETERMINED FOR ALL NODES?
NO
YES
S104
DECIDE ROOT
S105
SET NODE IDs
S106
END OF ID SETTING?
NO
YES
S107
TRANSFER DATA

FIG. 7

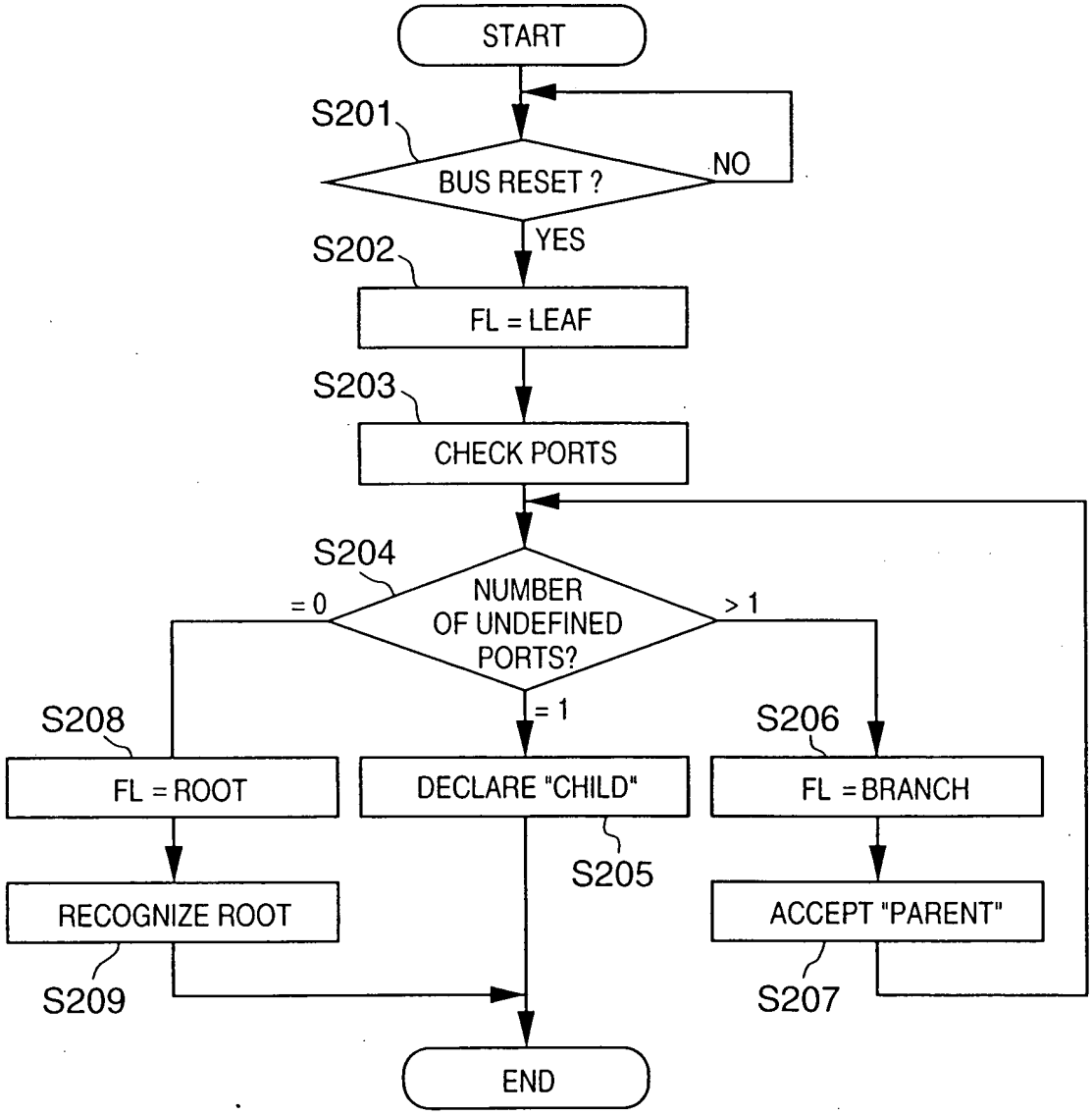

START
S201
BUS RESET ?
NO
YES
S202
FL = LEAF
S203
CHECK PORTS
S204
NUMBER OF UNDEFINED PORTS?
= 0
= 1
> 1
S208
FL = ROOT
RECOGNIZE ROOT
S209
DECLARE "CHILD"
S205
S206
FL = BRANCH
ACCEPT "PARENT"
S207
END

FIG. 8

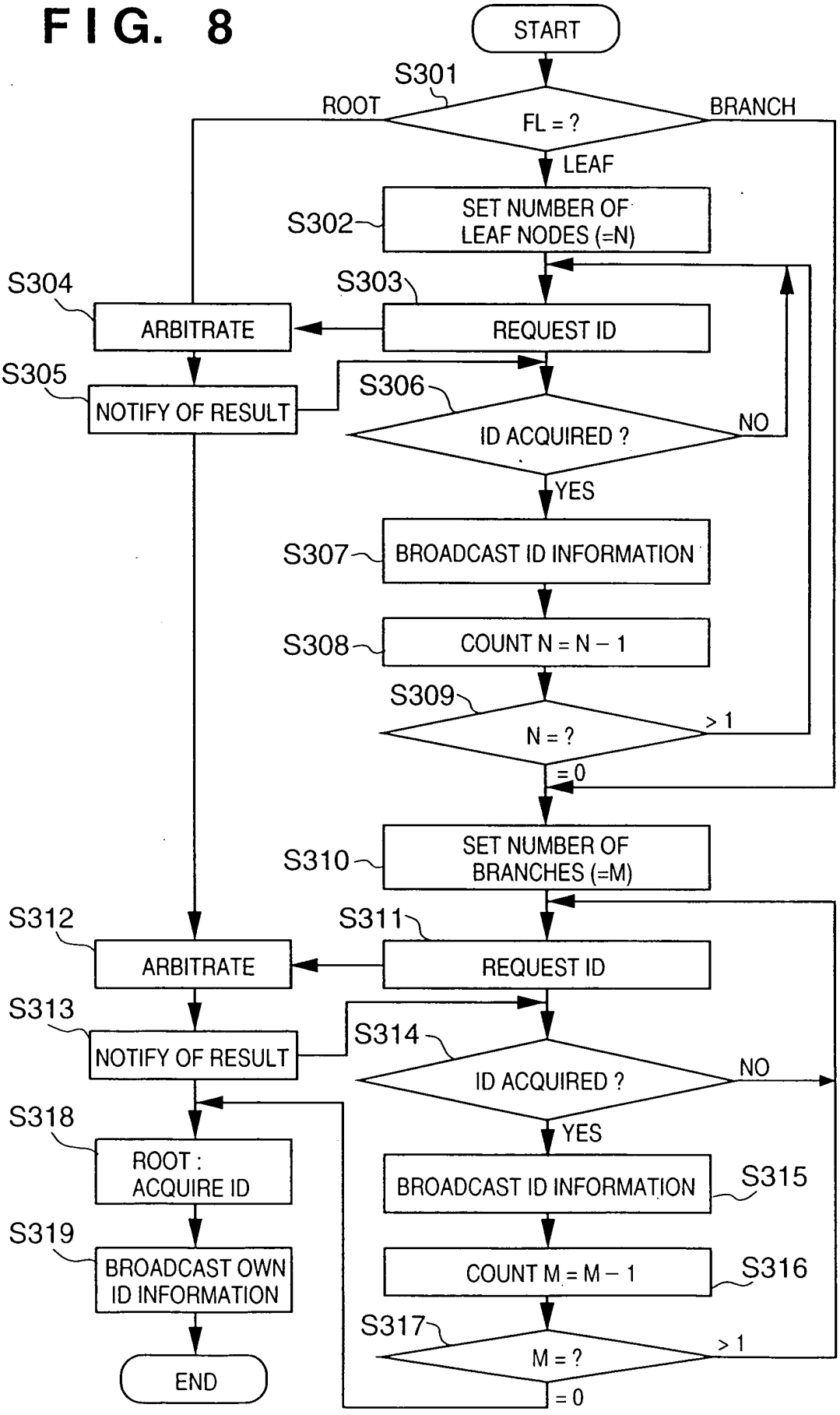
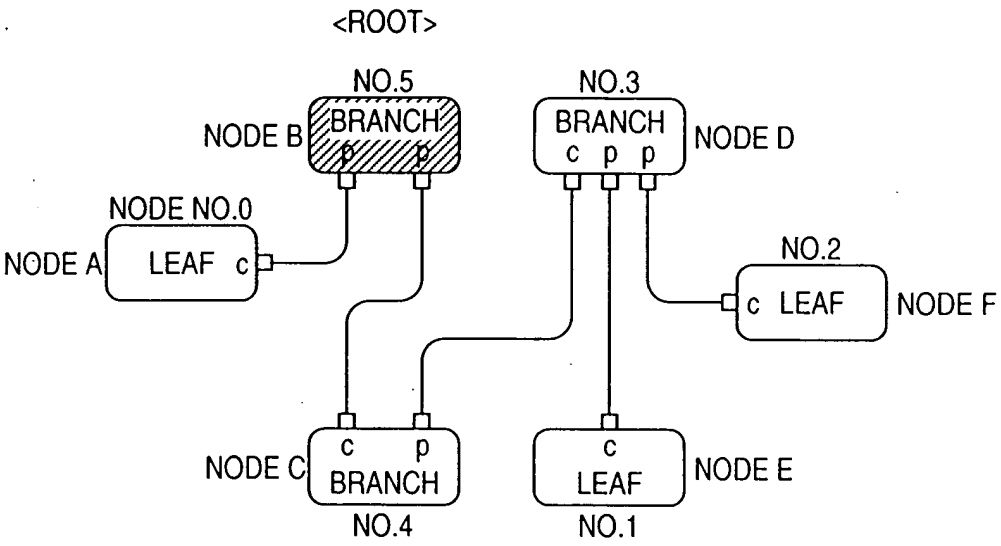

START
S301
FL = ?
ROOT
BRANCH
LEAF
S302
SET NUMBER OF LEAF NODES (=N)
S303
REQUEST ID
S304
ARBITRATE
S305
NOTIFY OF RESULT
S306
ID ACQUIRED ?
NO
YES
S307
BROADCAST ID INFORMATION
S308
COUNT N = N – 1
S309
N = ?
> 1
= 0
S310
SET NUMBER OF BRANCHES (=M)
S311
REQUEST ID
S312
ARBITRATE
S313
NOTIFY OF RESULT
S314
ID ACQUIRED ?
NO
YES
S315
BROADCAST ID INFORMATION
S316
COUNT M = M – 1
S317
M = ?
> 1
= 0
S318
ROOT : ACQUIRE ID
S319
BROADCAST OWN ID INFORMATION
END

FIG. 9



BRANCH : NODE TO WHICH TWO OR MORE NODES ARE CONNECTED

LEAF : NODE HAVING ONLY ONE PORT CONNECTED

□ : PORT
c : PORT THAT CORRESPONDS TO NODE OF CHILD
p : PORT THAT CORRESPONDS TO NODE OF PARENT

FIG. 10

CSR CORE REGISTER

OFFSET (HEXADECIMAL)	REGISTER NAME	FUNCTION
000	STATE_CLEAR	INFORMATION ABOUT STATUS AND CONTROL
004	STATE_SET	INFORMATION INDICATIVE OF WHETHER STATE_CLEAR CAN BE WRITTEN
008	NODE_IDS	BUS ID + NODE ID
00C	RESET_START	RESET BUS BY WRITE IN THIS AREA
010~014	INDIRECT_ADDRESS, INDIRECT_DATA	REGISTER FOR ACCESS ROM LARGER THAN 1K
018~01C	SPLIT_TIMEOUT	VALUE OF TIMER FOR DETECTING TIME-OUT OF SPLIT TRANSACTION
020~02C	ARGUMENT, TEST_START, TEST_STATUS	DIAGNOSTIC REGISTER
030~04C	UNITS_BASE, UNITS_BOUND, MEMORY_BASE, MEMORY_BOUND	UNUSED IN IEEE1394
050~054	INTERRUPT_TARGET, INTERRUPT_MASK	INTERRUPT NOTIFYING REGISTER
058~07C	CLOCK_VALUE, CLOCK_TICK_PERIOD, CLOCK_STROBE_ARRIVED, CLOCK_INFO	UNUSED IN IEEE1394
080~0FC	MESSAGE_REQUEST, MESSAGE_RESPONSE	MESSAGE NOTIFYING REGISTER
100~17C		RESERVED
180~1FC	ERROR_LOG_BUFFER	RESERVED FOR IEEE1394

FIG. 11

SERIAL BUS REGISTER

OFFSET (HEXADECIMAL)	REGISTER NAME	FUNCTION
200	CYCLE_TIME	COUNTER FOR ISOCHRONOUS TRANSFER
204	BUS_TIME	REGISTER FOR SYNCHRONIZING TIME
208	POWER_FAIL_IMMINENT	REGISTER CONCERNING POWER SUPPLY
20C	POWER_SOURCE	
210	BUSY_TIMEOUT	CONTROL RETRY OF TRANSACTION LAYER
214~218		RESERVED
21C	BUS_MANAGER_ID	NODE ID OF BUS MANAGER
220	BANDWIDTH_AVAILABLE	MANAGE ISOCHRONOUS TRANSFER BANDWIDTH
224~228	CHANNELS_AVAILABLE	MANAGE ISOCHRONOUS TRANSFER CHANNEL NUMBER
22C	MAINT_CONTROL	DIAGNOSTIC REGISTER
230	MAINT_UTILITY	
234~3FC		RESERVED

FIG. 12

SERIAL BUS DEVICE REGISTER

OFFSET (HEXADECIMAL)	REGISTER NAME	FUNCTION
800~FFC		RESERVED
1000~13FC	TOPOLOGY_MAP	INFORMATION ABOUT CONFIGURATION OF SERIAL BUS
1400~1FFC		RESERVED
2000~2FFC	SPEED_MAP	INFORMATION ABOUT TRANSFER SPEED OF SERIAL BUS
3000~FFFC		RESERVED

FIG. 13

CONFIGURATION ROM OF MINIMUM FORMAT

01	VENDOR ID

FIG. 14

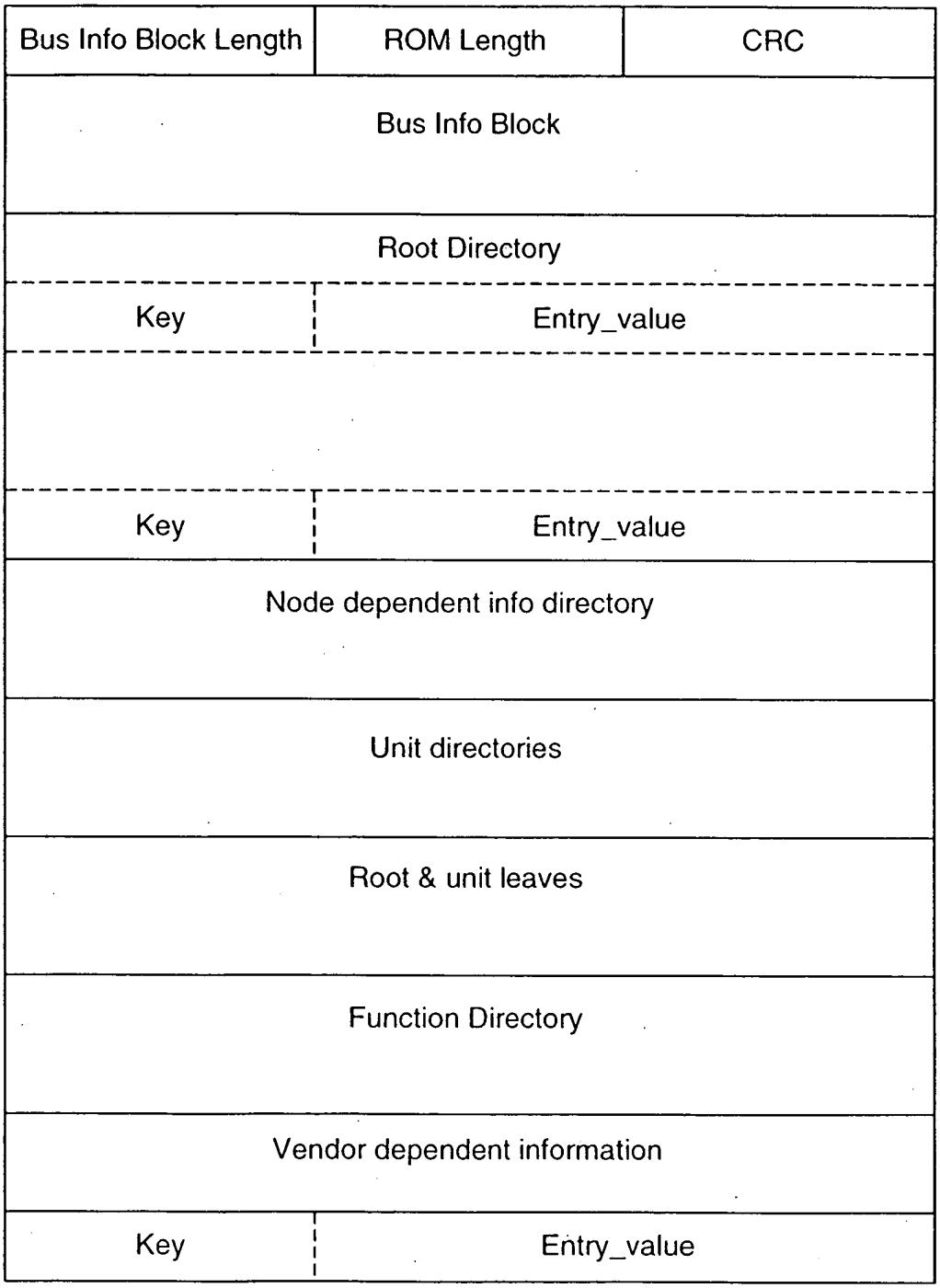

Bus Info Block Length
ROM Length
CRC
Bus Info Block
Root Directory
Key
Entry_value
Key
Entry_value
Node dependent info directory
Unit directories
Root & unit leaves
Function Directory
Vendor dependent information
Key
Entry_value

FIG. 15

REQUESTS FOR BUS ACCESS

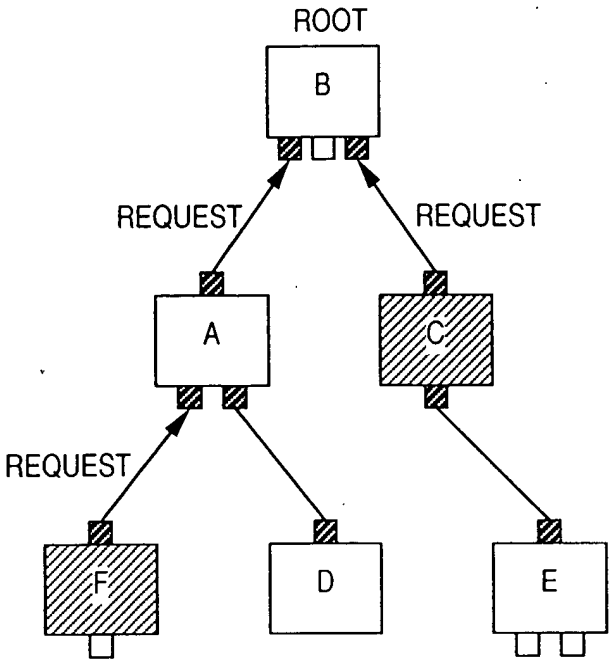


FIG. 16

BUS ACCESS GRANTED

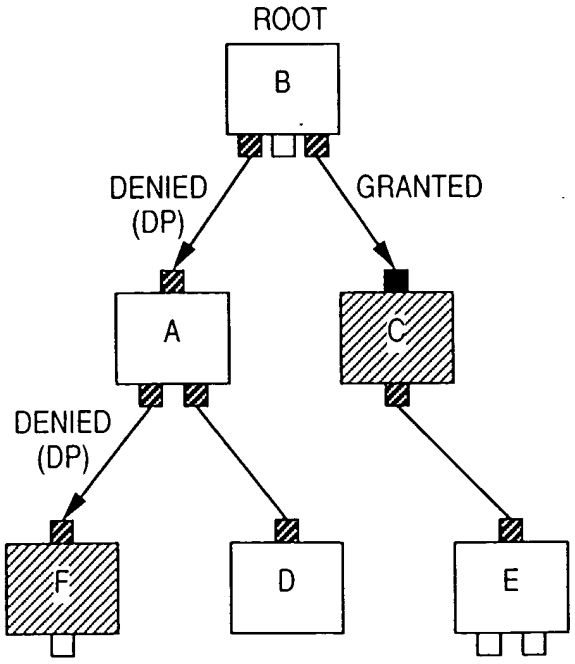


FIG. 17

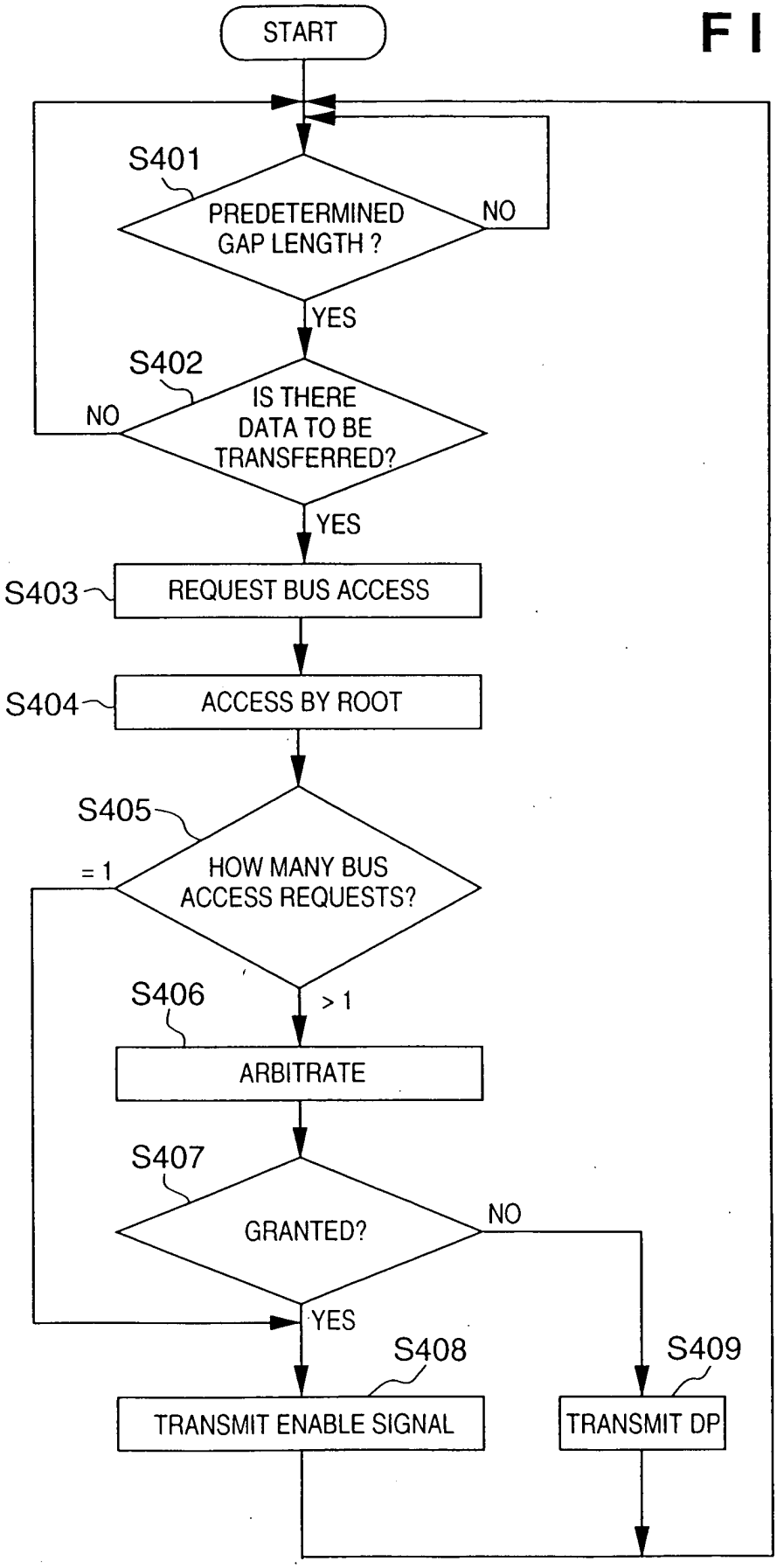

START
S401
PREDETERMINED GAP LENGTH ?
NO
YES
S402
IS THERE DATA TO BE TRANSFERRED?
NO
YES
S403
REQUEST BUS ACCESS
S404
ACCESS BY ROOT
S405
HOW MANY BUS ACCESS REQUESTS?
= 1
> 1
S406
ARBITRATE
S407
GRANTED?
NO
YES
S408
TRANSMIT ENABLE SIGNAL
S409
TRANSMIT DP

FIG. 18

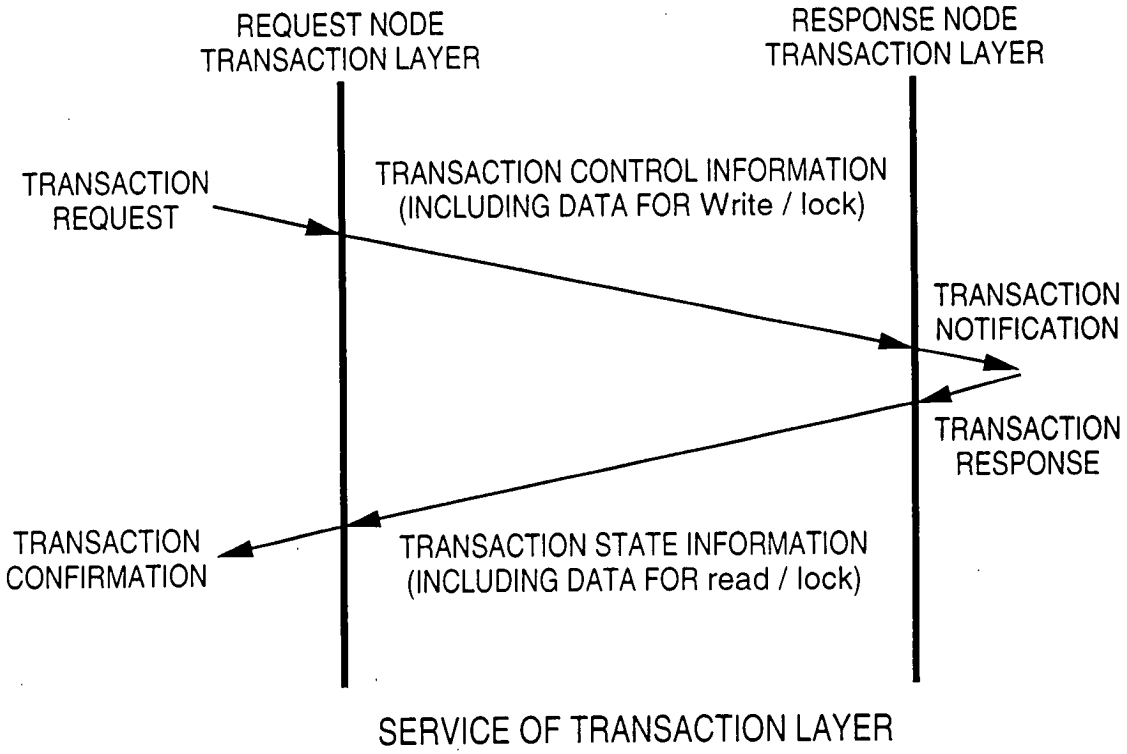
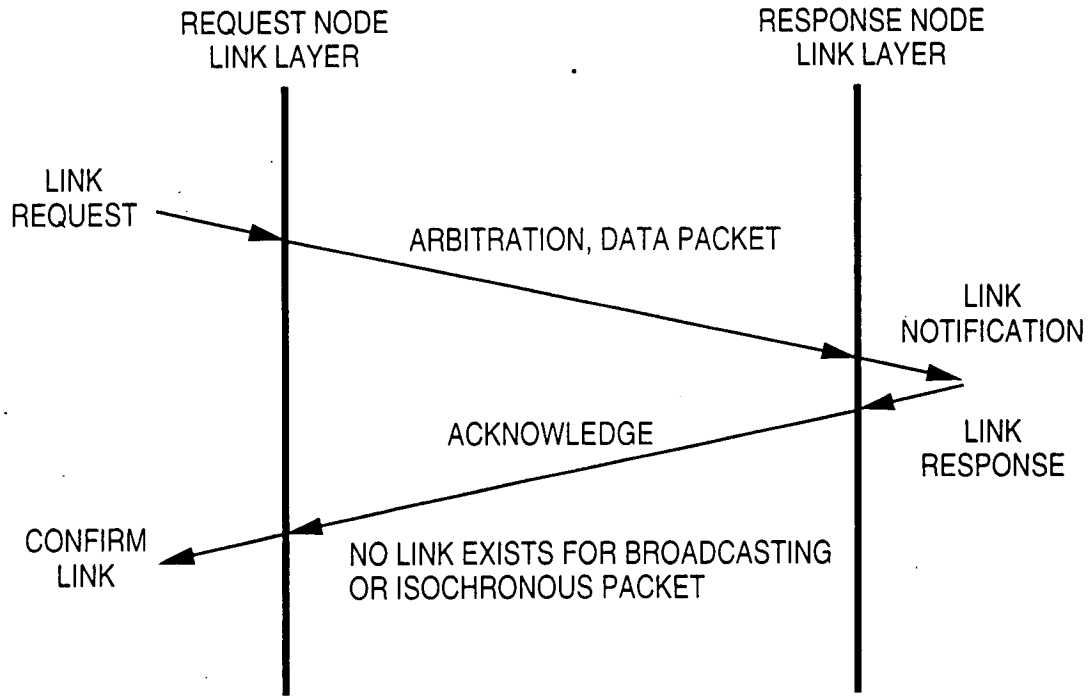

REQUEST NODE
TRANSACTION LAYER
RESPONSE NODE
TRANSACTION LAYER
TRANSACTION
REQUEST
TRANSACTION CONTROL INFORMATION
(INCLUDING DATA FOR Write / lock)
TRANSACTION
NOTIFICATION
TRANSACTION
RESPONSE
TRANSACTION
CONFIRMATION
TRANSACTION STATE INFORMATION
(INCLUDING DATA FOR read / lock)
SERVICE OF TRANSACTION LAYER

FIG. 19



SERVICE OF LINK LAYER

FIG. 20

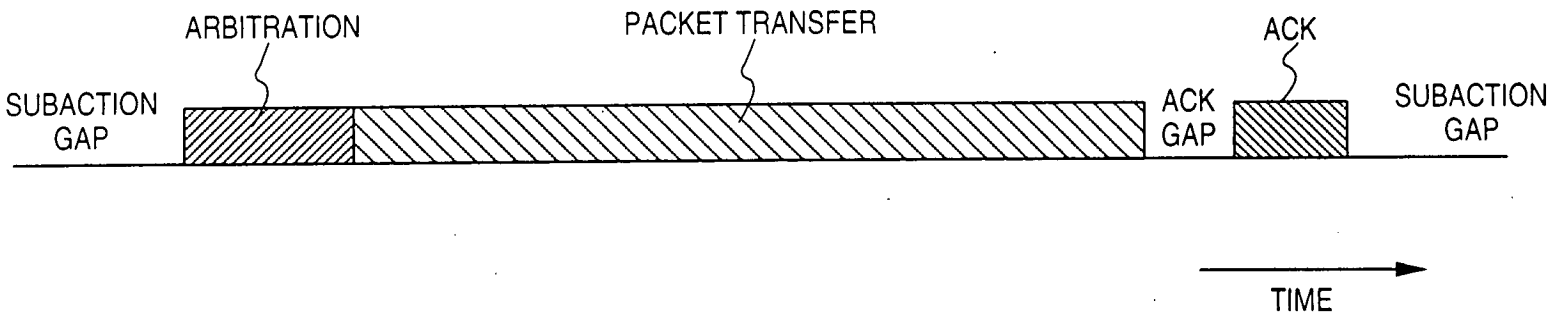

ARBITRATION
PACKET TRANSFER
ACK
SUBACTION GAP
ACK GAP
SUBACTION GAP
TIME

FIG. 21

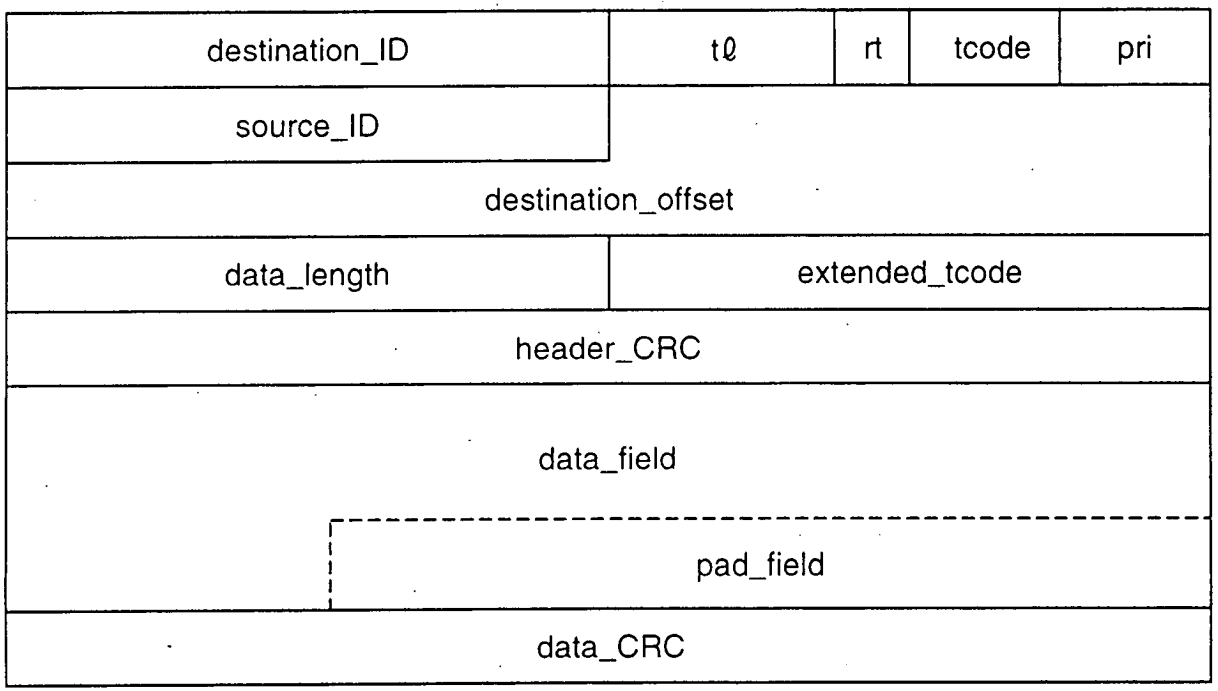

destination_ID
tℓ
rt
tcode
pri
source_ID
destination_offset
data_length
extended_tcode
header_CRC
data_field
pad_field
data_CRC

FIG. 22

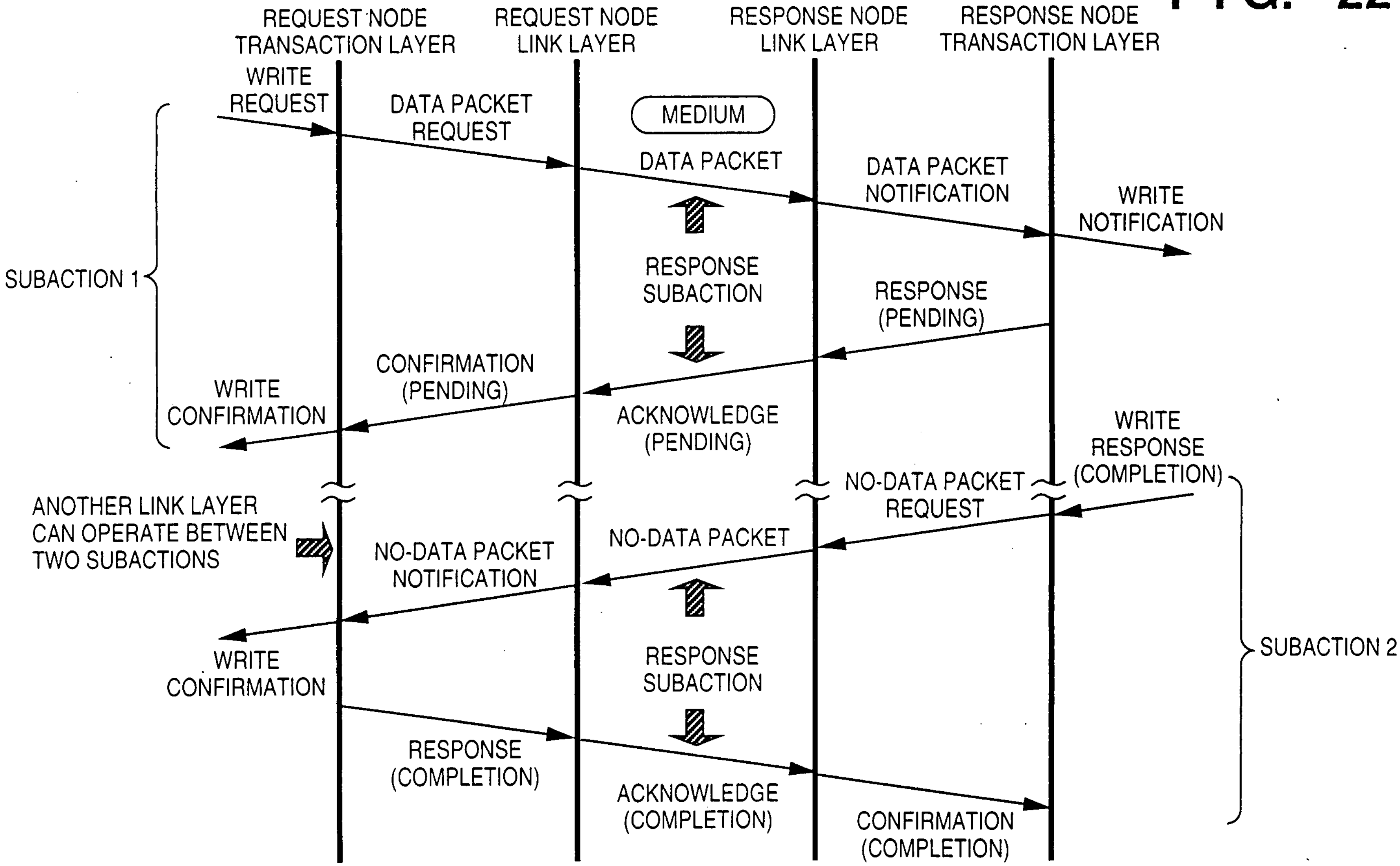

REQUEST NODE TRANSACTION LAYER
REQUEST NODE LINK LAYER
RESPONSE NODE LINK LAYER
RESPONSE NODE TRANSACTION LAYER
WRITE REQUEST
DATA PACKET REQUEST
MEDIUM
DATA PACKET
DATA PACKET NOTIFICATION
WRITE NOTIFICATION
SUBACTION 1
RESPONSE SUBACTION
RESPONSE (PENDING)
CONFIRMATION (PENDING)
WRITE CONFIRMATION
ACKNOWLEDGE (PENDING)
WRITE RESPONSE (COMPLETION)
NO-DATA PACKET REQUEST
ANOTHER LINK LAYER CAN OPERATE BETWEEN TWO SUBACTIONS
NO-DATA PACKET
NO-DATA PACKET NOTIFICATION
WRITE CONFIRMATION
RESPONSE SUBACTION
SUBACTION 2
RESPONSE (COMPLETION)
ACKNOWLEDGE (COMPLETION)
CONFIRMATION (COMPLETION)

FIG. 23

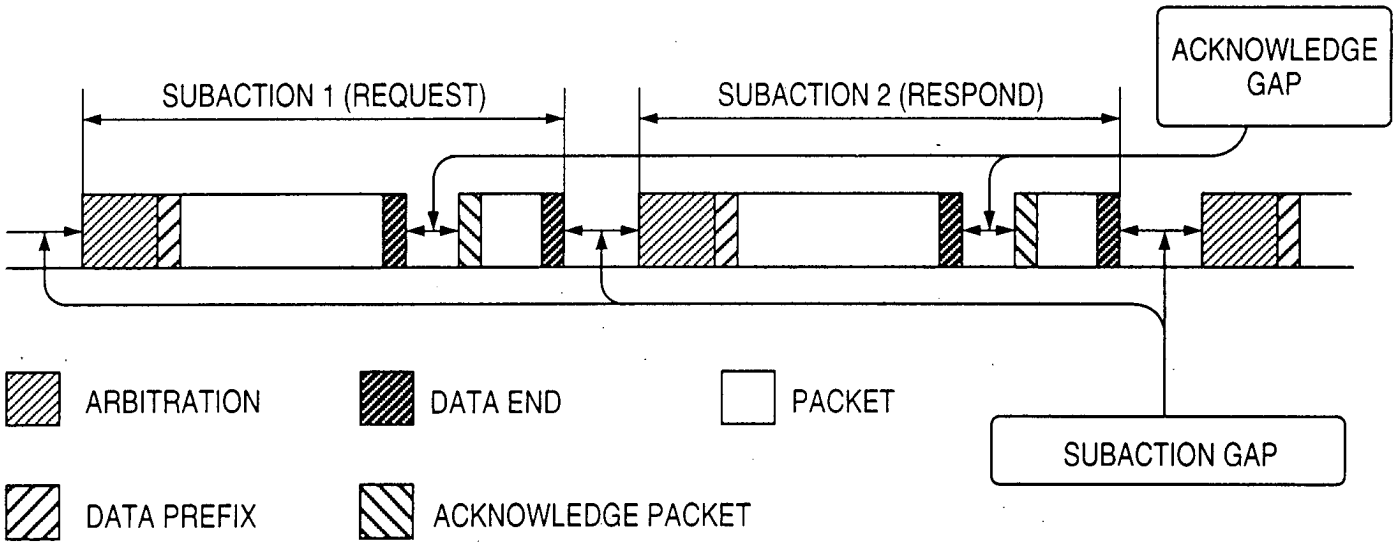
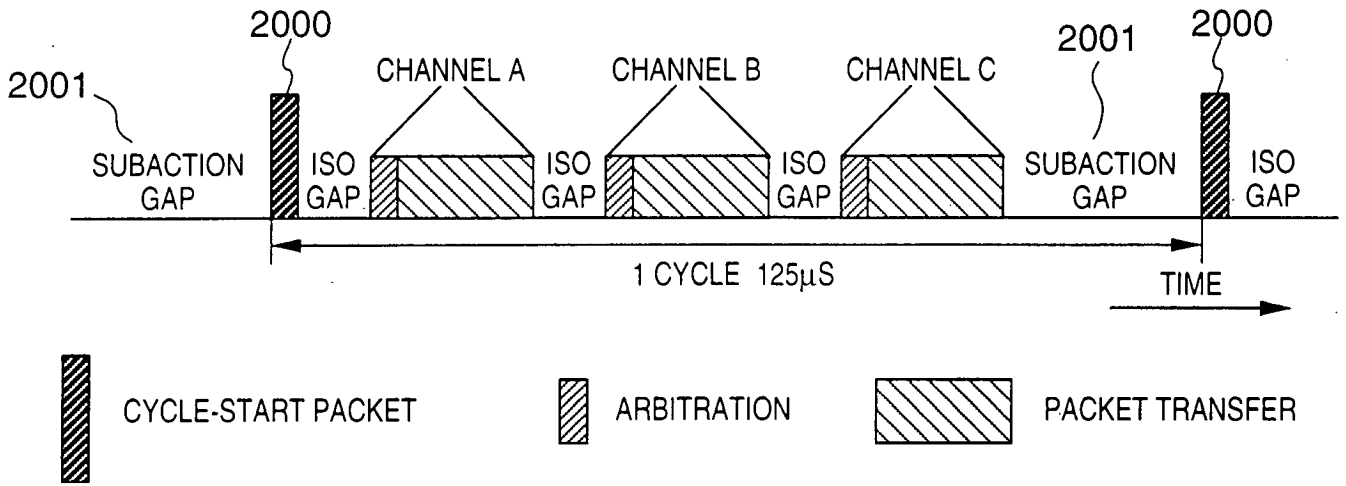


FIG. 24



ISO GAP : ISOCHRONOUS GAP

FIG. 25

PACKET OF ISOCHRONOUS DATA

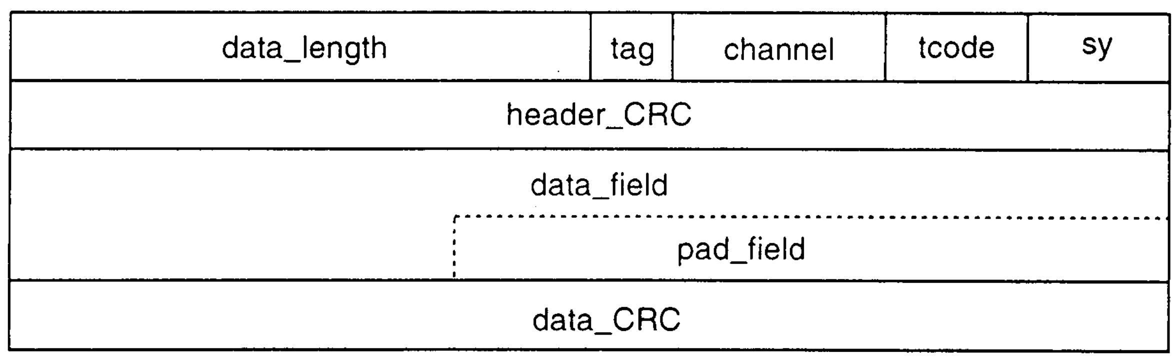


FIG. 26

ABBREVIATION	NAME	CONTENT
destination_ID	destination identifier	REPRESENT ID OF DESTINATION NODE (FOR ONLY ASYNCHRONOUS TRANSFER)
t ℓ	transaction label	LABEL FOR REPRESENTING SERIES OF TRANSACTIONS (FOR ONLY ASYNCHRONOUS TRANSFER)
rt	retry code	CODE INDICATIVE OF RETRY STATUS (FOR ONLY ASYNCHRONOUS TRANSFER)
tcode	transaction code	CODE INDICATIVE OF TYPE OF PACKET (FOR ONLY ASYNCHRONOUS TRANSFER)
pri	priority	PRIORITY (FOR ONLY ASYNCHRONOUS TRANSFER)
source_ID	source identifier	TRANSMISSION SOURCE NODE (FOR ONLY ASYNCHRONOUS TRANSFER)
destination_ offset	destination memory address	MEMORY ADDRESS OF DESTINATION NODE (FOR ONLY ASYNCHRONOUS TRANSFER)
rcode	response code	RESPONSE STATUS (FOR ONLY ASYNCHRONOUS TRANSFER)
quadiet_data	quadiet (4bytes) data	4-BYTE DATA (FOR ONLY ASYNCHRONOUS TRANSFER)
data_length	length of data	LENGTH OF data_field (EXCEPT FOR pad bytes)
extended_tcode	extended transaction code	EXTENDED TRANSACTION CODE (FOR ONLY ASYNCHRONOUS TRANSFER)
chanel	isochronous identifier	IDENTIFY ISOCHRONOUS PACKET
sy	synchronization code	USED TO SYNCHRONIZE VIDEO DATA, AUDIO DATA, AND THE LIKE (FOR ONLY ASYNCHRONOUS TRANSFER)
cycle_time_data	contents of the CYCLE_TIME register	VALUE OF CYCLE TIMER REGISTER OF CYCLE MASTER NODE (FOR ONLY CYCLE PACKET)
data_field	data + pad bytes	DATA IS STORED (FOR ISOCHRONOUS AND ASYNCHRONOUS TRANSFER)
header_CRC	CRC for header field	CRC CORRESPONDING TO HEADER
data_CRC	CRC for data field	CRC CORRESPONDING TO DATA
tag	tag label	FORMAT OF ISOCHRONOUS PACKET

FIG. 27

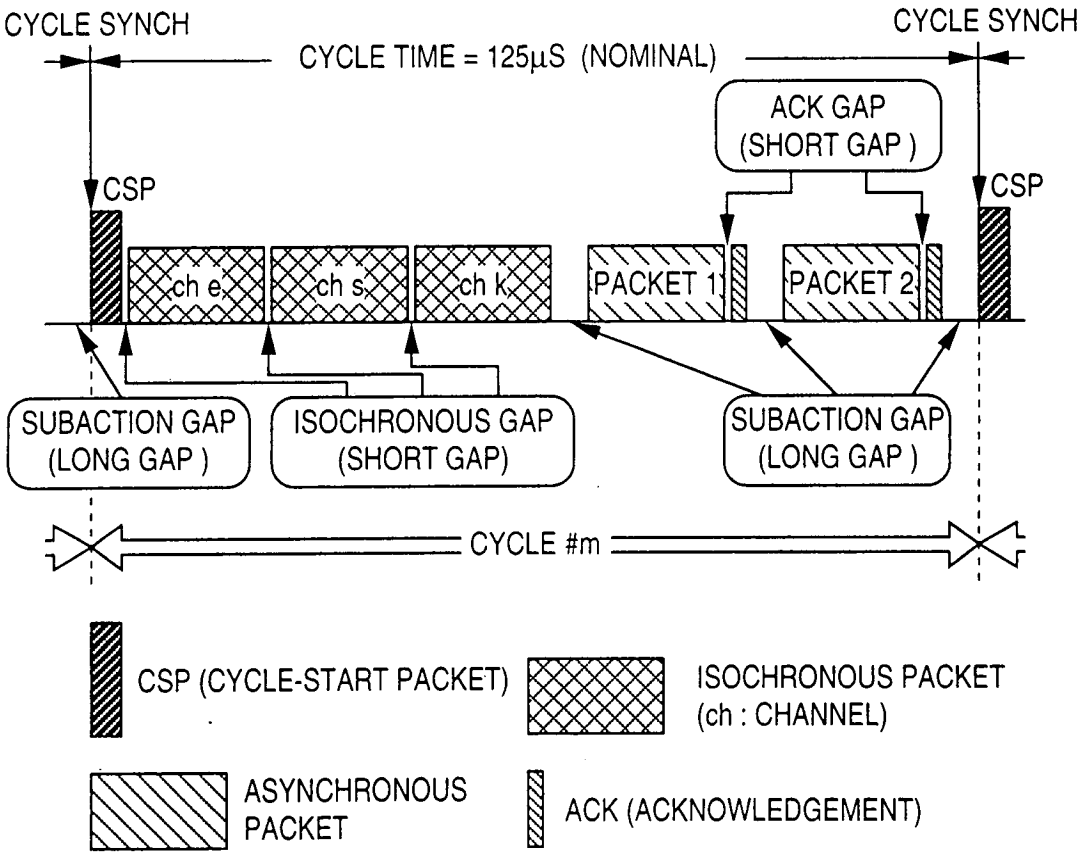


FIG. 28

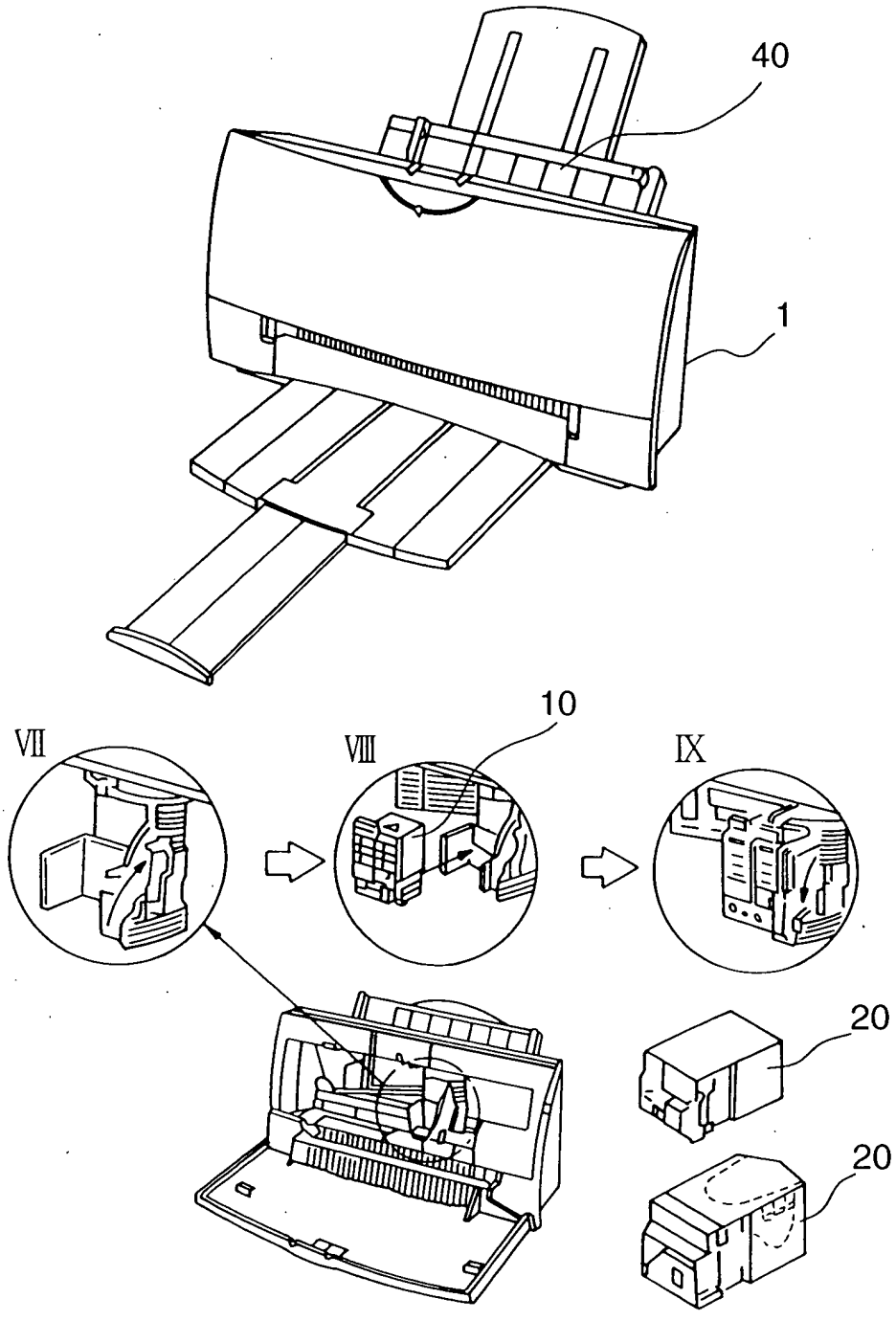


FIG. 29

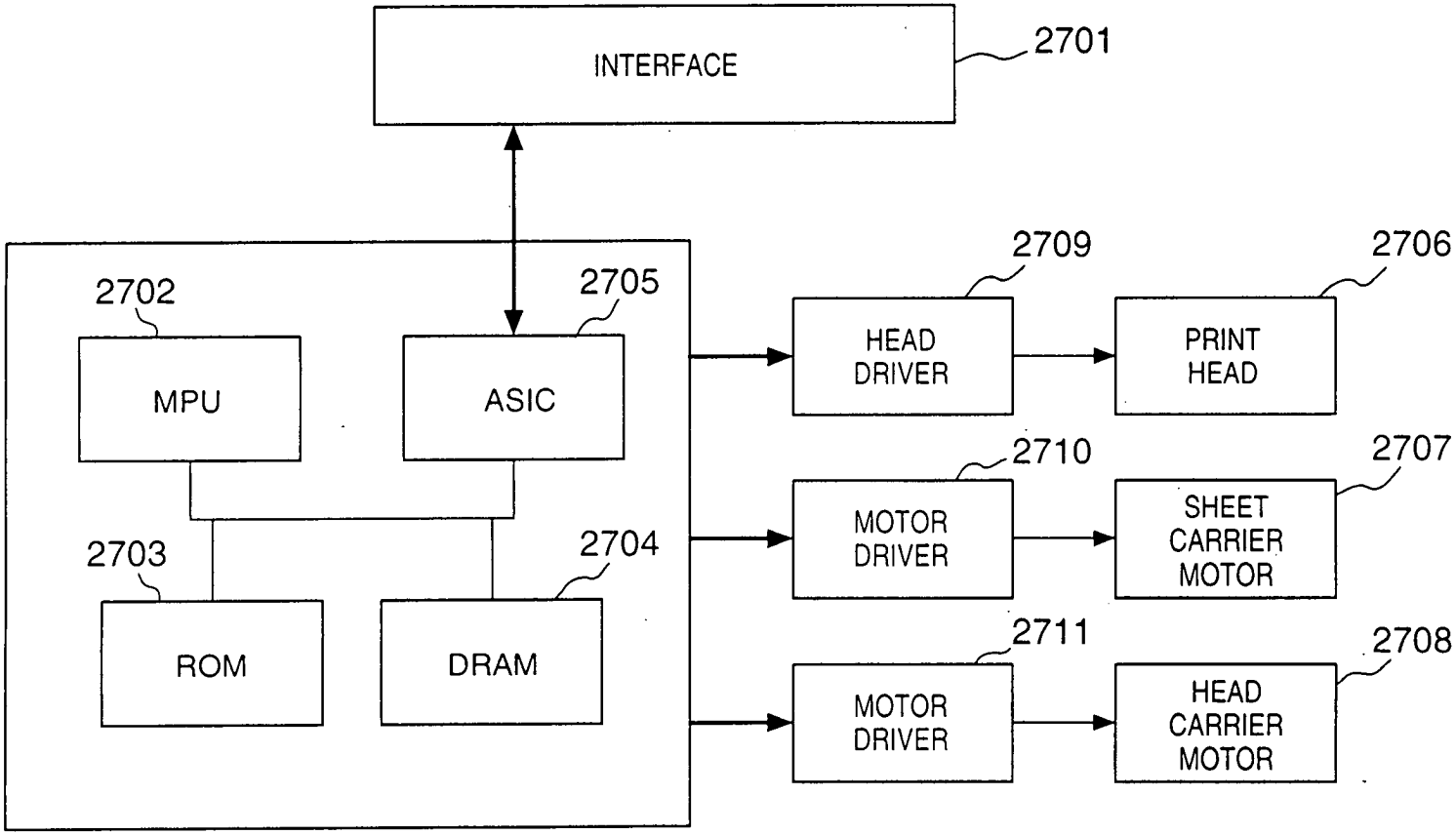


FIG. 30

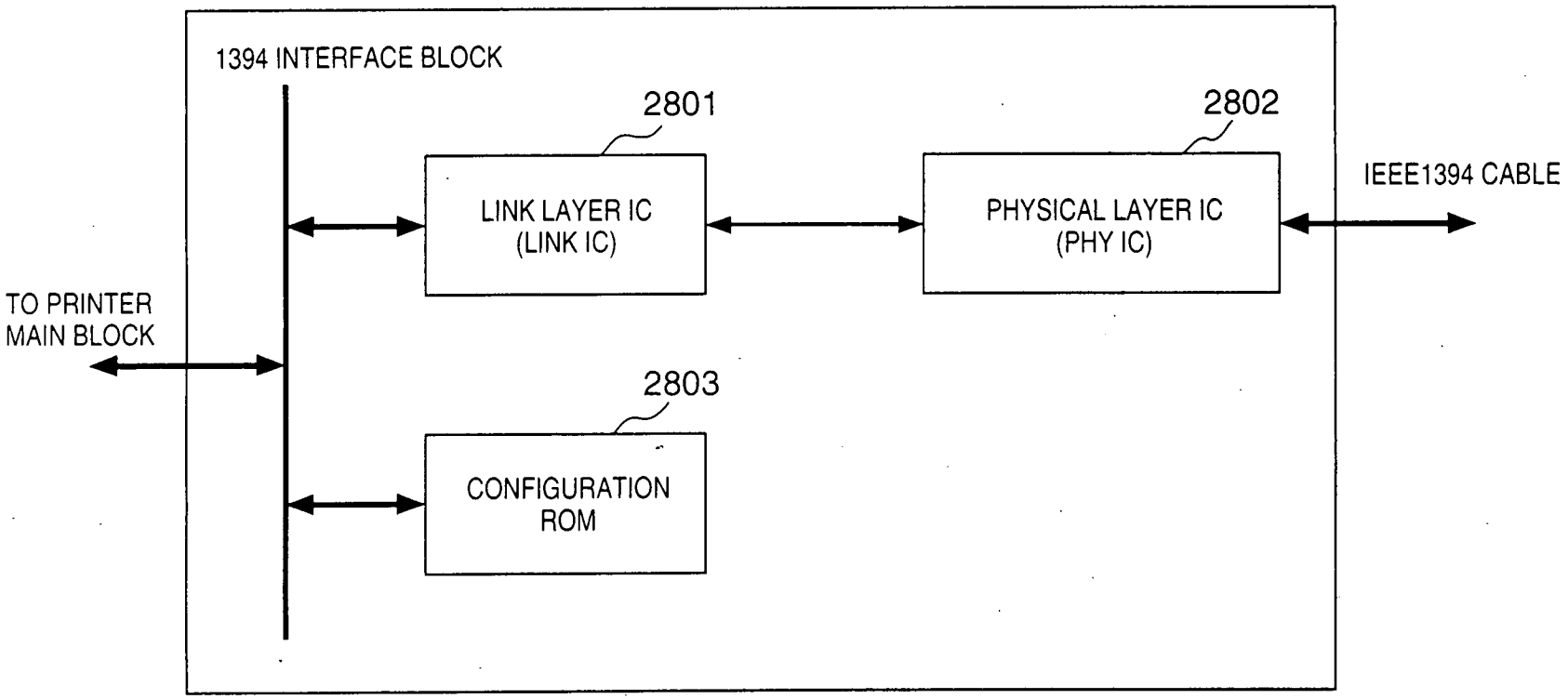


FIG. 31

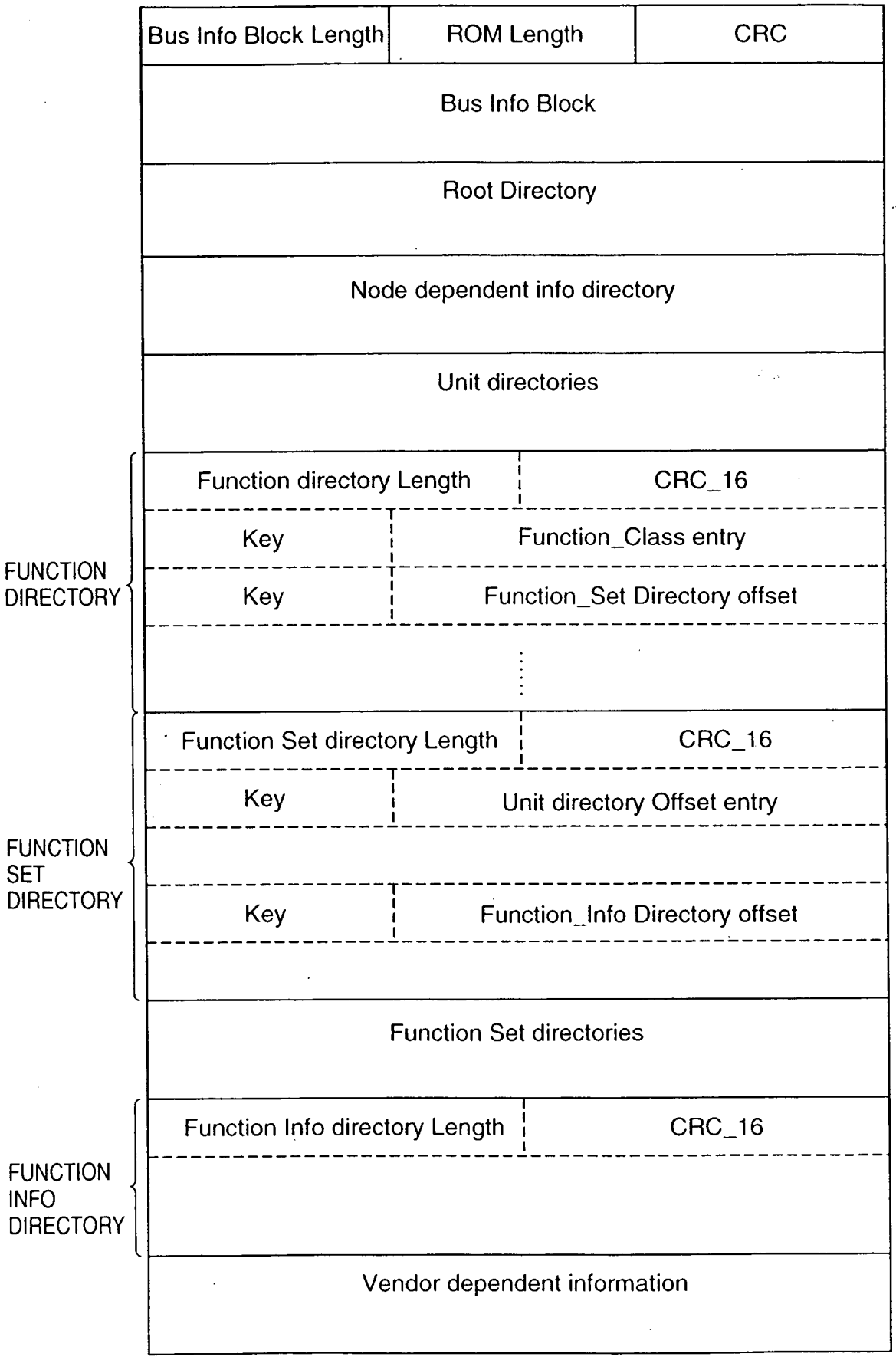

Bus Info Block Length
ROM Length
CRC
Bus Info Block
Root Directory
Node dependent info directory
Unit directories
FUNCTION DIRECTORY
Function directory Length
CRC_16
Key
Function_Class entry
Key
Function_Set Directory offset
FUNCTION SET DIRECTORY
Function Set directory Length
CRC_16
Key
Unit directory Offset entry
Key
Function_Info Directory offset
Function Set directories
FUNCTION INFO DIRECTORY
Function Info directory Length
CRC_16
Vendor dependent information

FIG. 32

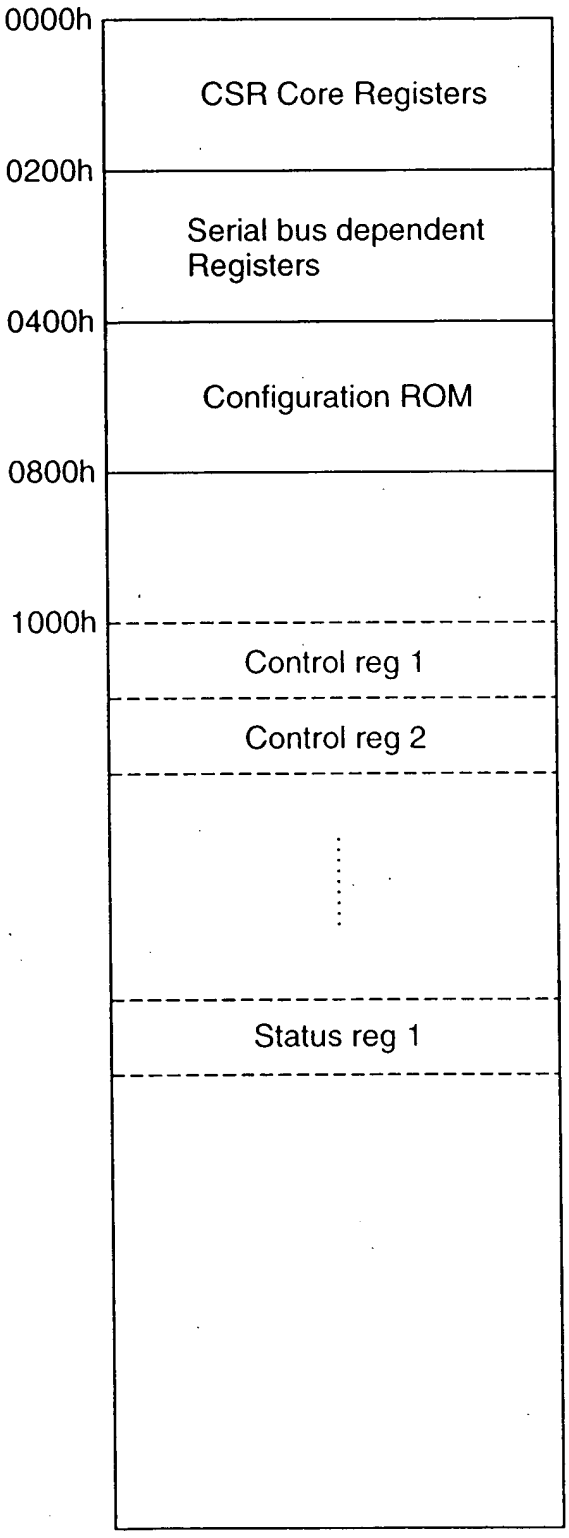

0000h
CSR Core Registers
0200h
Serial bus dependent Registers
0400h
Configuration ROM
0800h
1000h
Control reg 1
Control reg 2
Status reg 1

FIG. 33

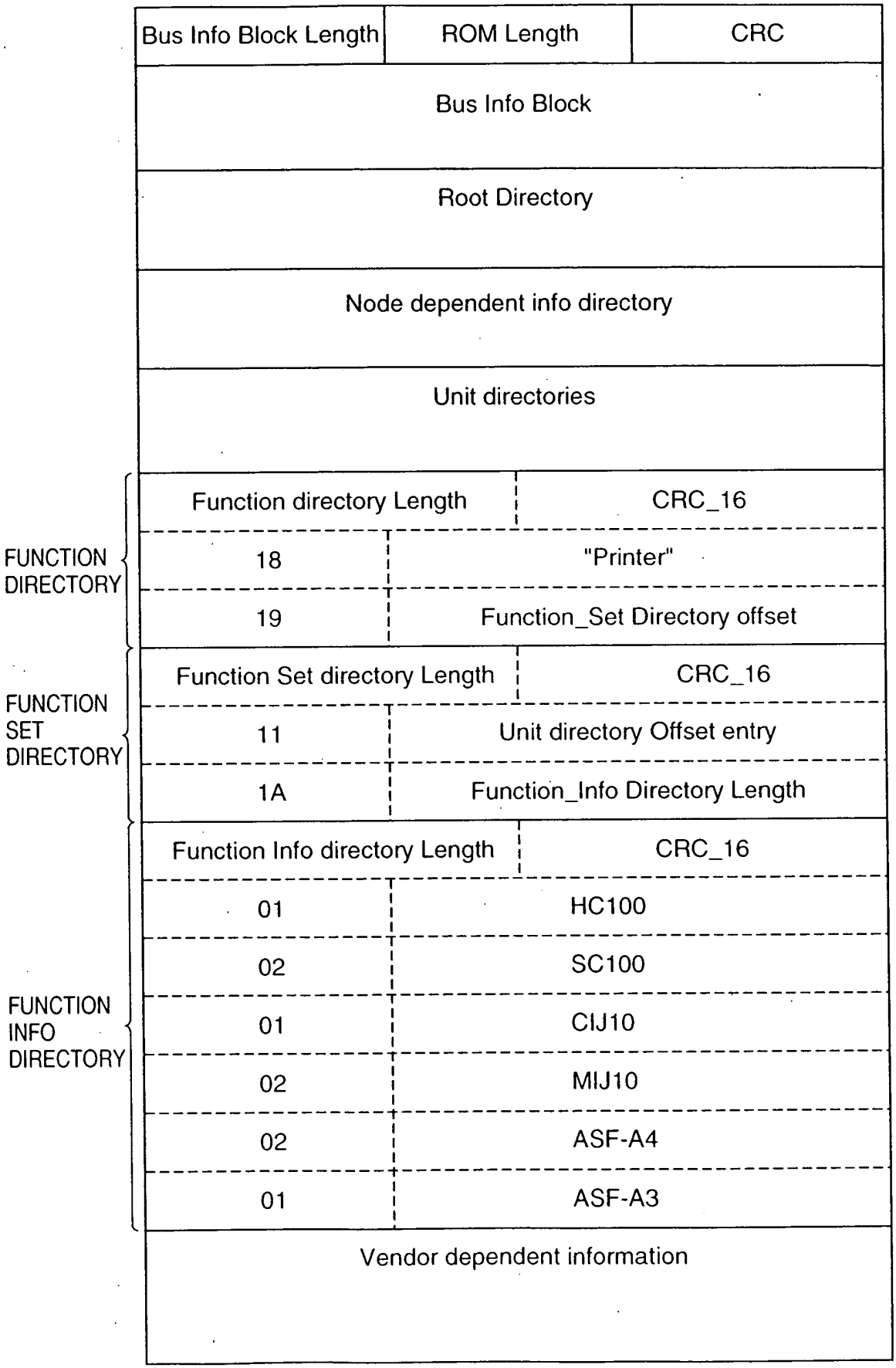

Bus Info Block Length
ROM Length
CRC
Bus Info Block
Root Directory
Node dependent info directory
Unit directories
FUNCTION DIRECTORY
Function directory Length
CRC_16
18
"Printer"
19
Function_Set Directory offset
FUNCTION SET DIRECTORY
Function Set directory Length
CRC_16
11
Unit directory Offset entry
1A
Function_Info Directory Length
FUNCTION INFO DIRECTORY
Function Info directory Length
CRC_16
01
HC100
02
SC100
01
CIJ10
02
MIJ10
02
ASF-A4
01
ASF-A3
Vendor dependent information

FIG. 34

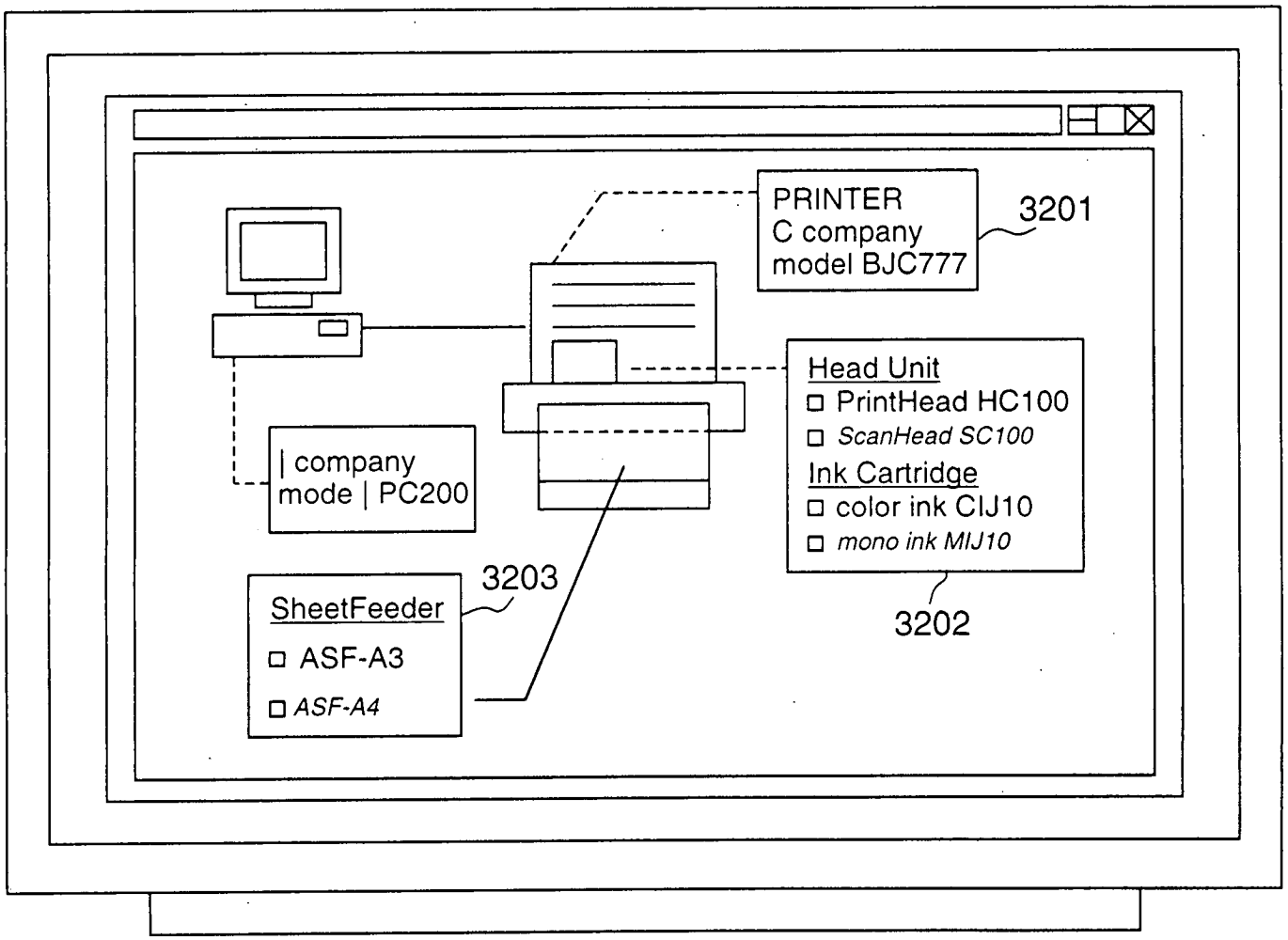

PRINTER
C company
model BJC777
3201
Head Unit
PrintHead HC100
ScanHead SC100
Ink Cartridge
color ink CIJ10
mono ink MIJ10
3202
| company
mode | PC200
SheetFeeder
ASF-A3
ASF-A4
3203

FIG. 35

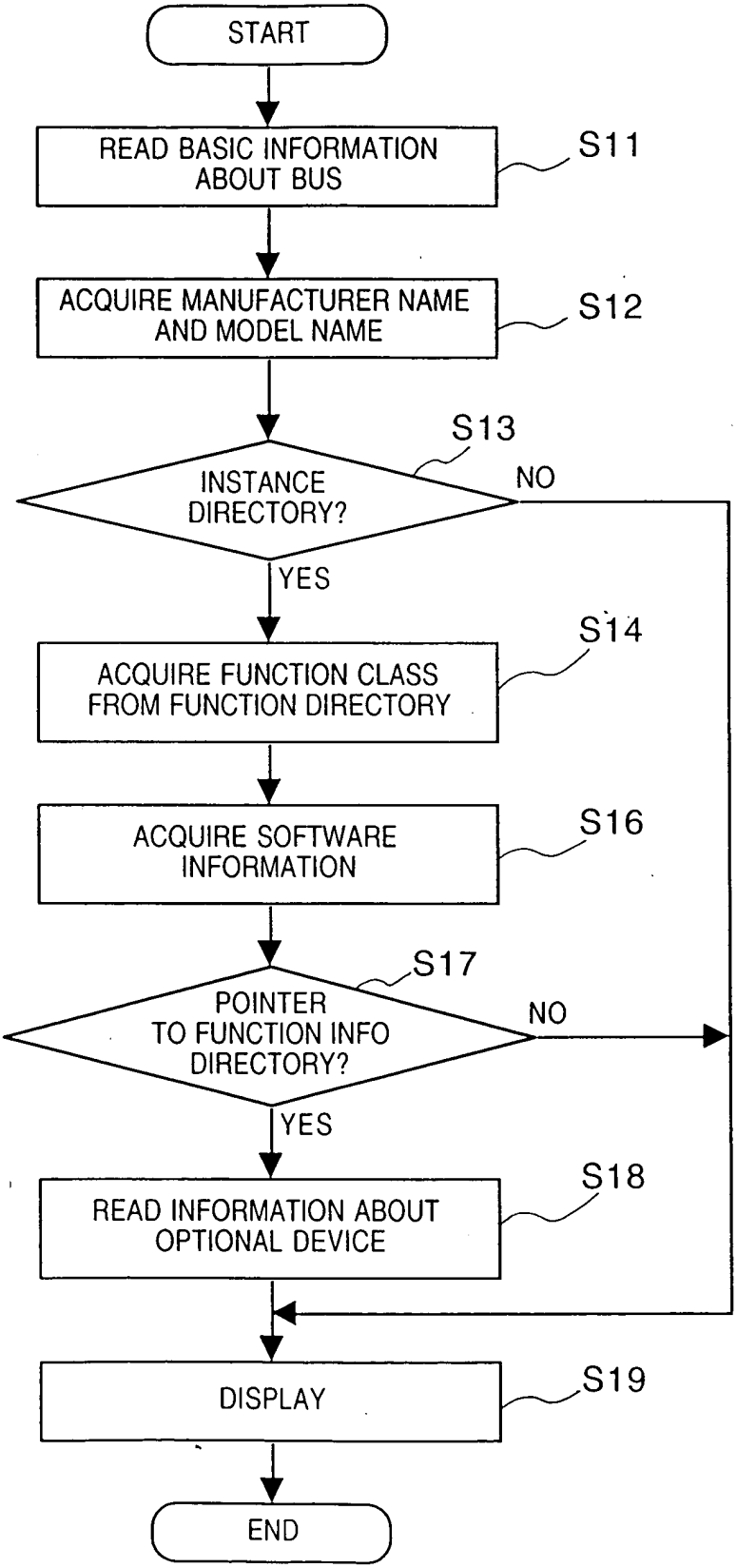

START
READ BASIC INFORMATION ABOUT BUS
S11
ACQUIRE MANUFACTURER NAME AND MODEL NAME
S12
S13
INSTANCE DIRECTORY?
NO
YES
S14
ACQUIRE FUNCTION CLASS FROM FUNCTION DIRECTORY
ACQUIRE SOFTWARE INFORMATION
S16
S17
POINTER TO FUNCTION INFO DIRECTORY?
NO
YES
S18
READ INFORMATION ABOUT OPTIONAL DEVICE
DISPLAY
S19
END

FIG. 36

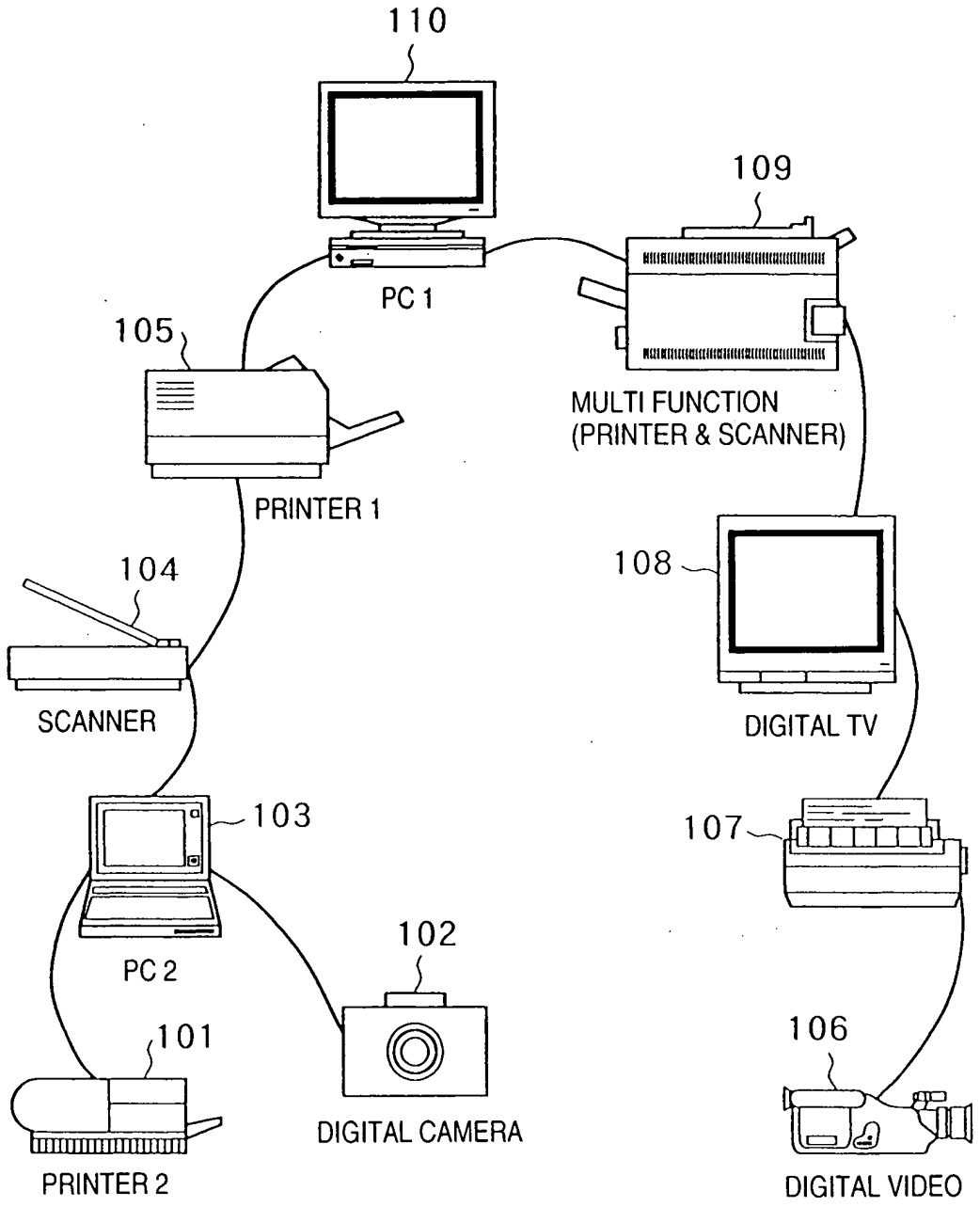

110
PC 1
109
MULTI FUNCTION
(PRINTER & SCANNER)
105
PRINTER 1
104
SCANNER
108
DIGITAL TV
103
PC 2
107
102
DIGITAL CAMERA
101
PRINTER 2
106
DIGITAL VIDEO

FIG. 37

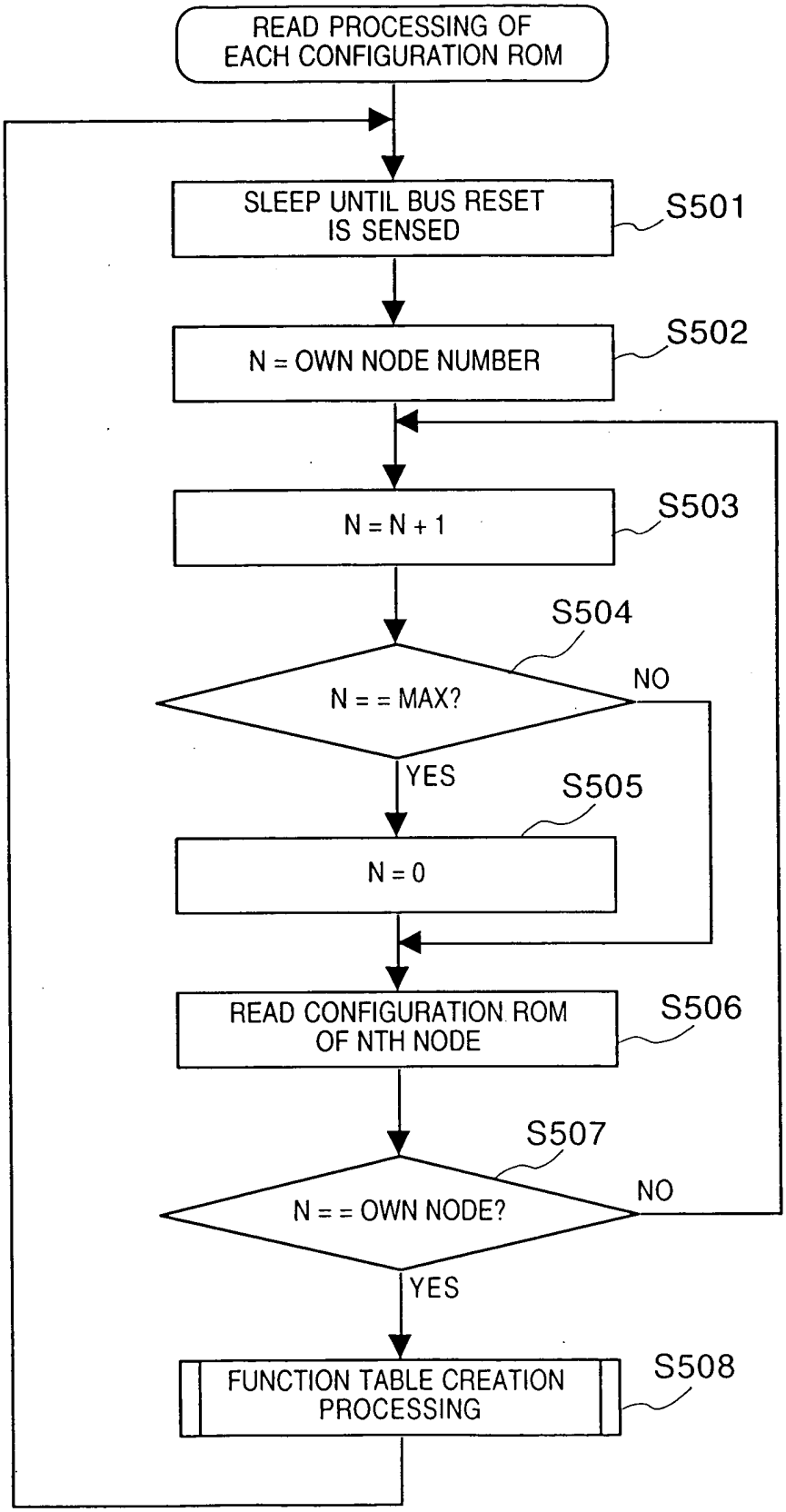

READ PROCESSING OF EACH CONFIGURATION ROM
SLEEP UNTIL BUS RESET IS SENSED
S501
N = OWN NODE NUMBER
S502
N = N + 1
S503
S504
N = = MAX?
NO
YES
S505
N = 0
READ CONFIGURATION ROM OF NTH NODE
S506
S507
N = = OWN NODE?
NO
YES
FUNCTION TABLE CREATION PROCESSING
S508

FIG. 38A

INPUT	IMAGE PROCESSING	SPEED	QUALITY
DIGITAL CAMERA	○	6.0	XGA
SCANNER	×	0.5	2400dpi
DIGITAL VIDEO (*)	×	10.0	VGA
DIGITAL TV (*)	×	×	VGA
MULTI FUNCTION (*)	○	2.0	1200dpi

FIG. 38B

OUTPUT	IMAGE PROCESSING	SPEED	QUALITY
PRINTER 1	○	1.5	720dpi
PRINTER 2	○	1.5	720dpi
PRINTER 3	×	1.0	360dpi
DIGITAL VIDEO (*)	×	10.0	VGA
DIGITAL TV (*)	×	×	VGA
MULTI FUNCTION (*)	○	2.0	1200dpi

FIG. 39

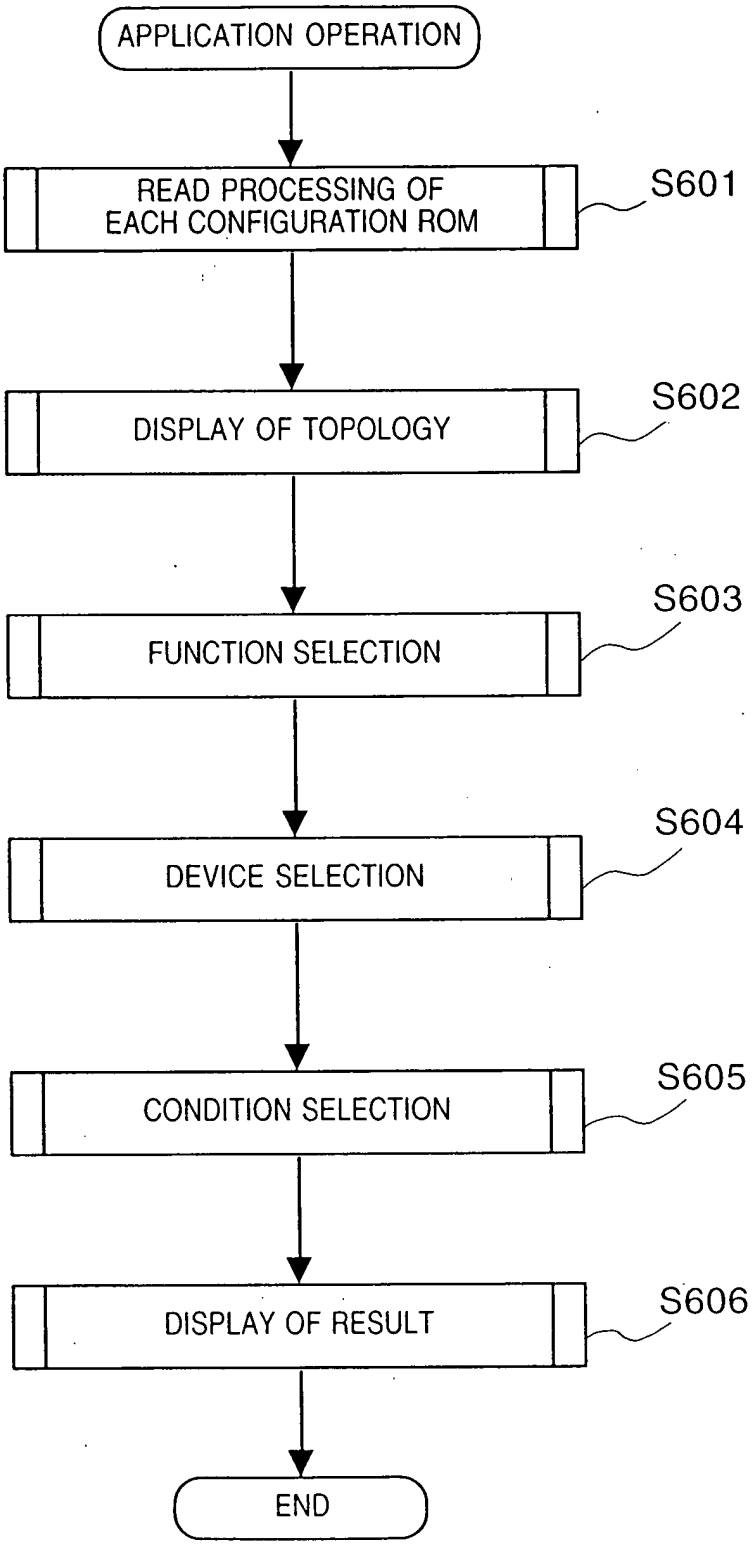

APPLICATION OPERATION
READ PROCESSING OF EACH CONFIGURATION ROM
S601
DISPLAY OF TOPOLOGY
S602
FUNCTION SELECTION
S603
DEVICE SELECTION
S604
CONDITION SELECTION
S605
DISPLAY OF RESULT
S606
END

FIG. 40

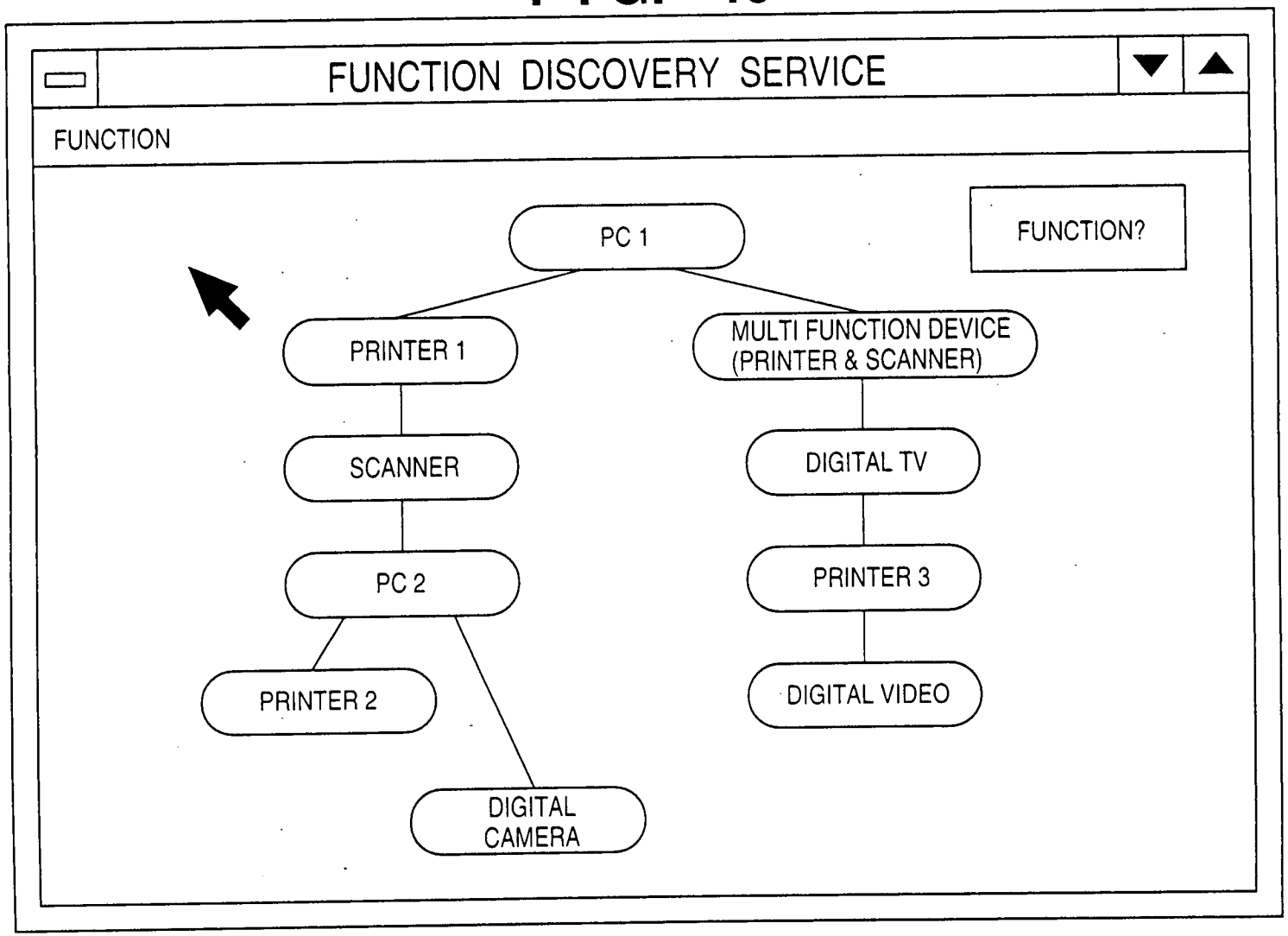

FUNCTION DISCOVERY SERVICE
FUNCTION
FUNCTION?
PC 1
PRINTER 1
MULTI FUNCTION DEVICE (PRINTER & SCANNER)
SCANNER
DIGITAL TV
PC 2
PRINTER 3
PRINTER 2
DIGITAL VIDEO
DIGITAL CAMERA

FIG. 41

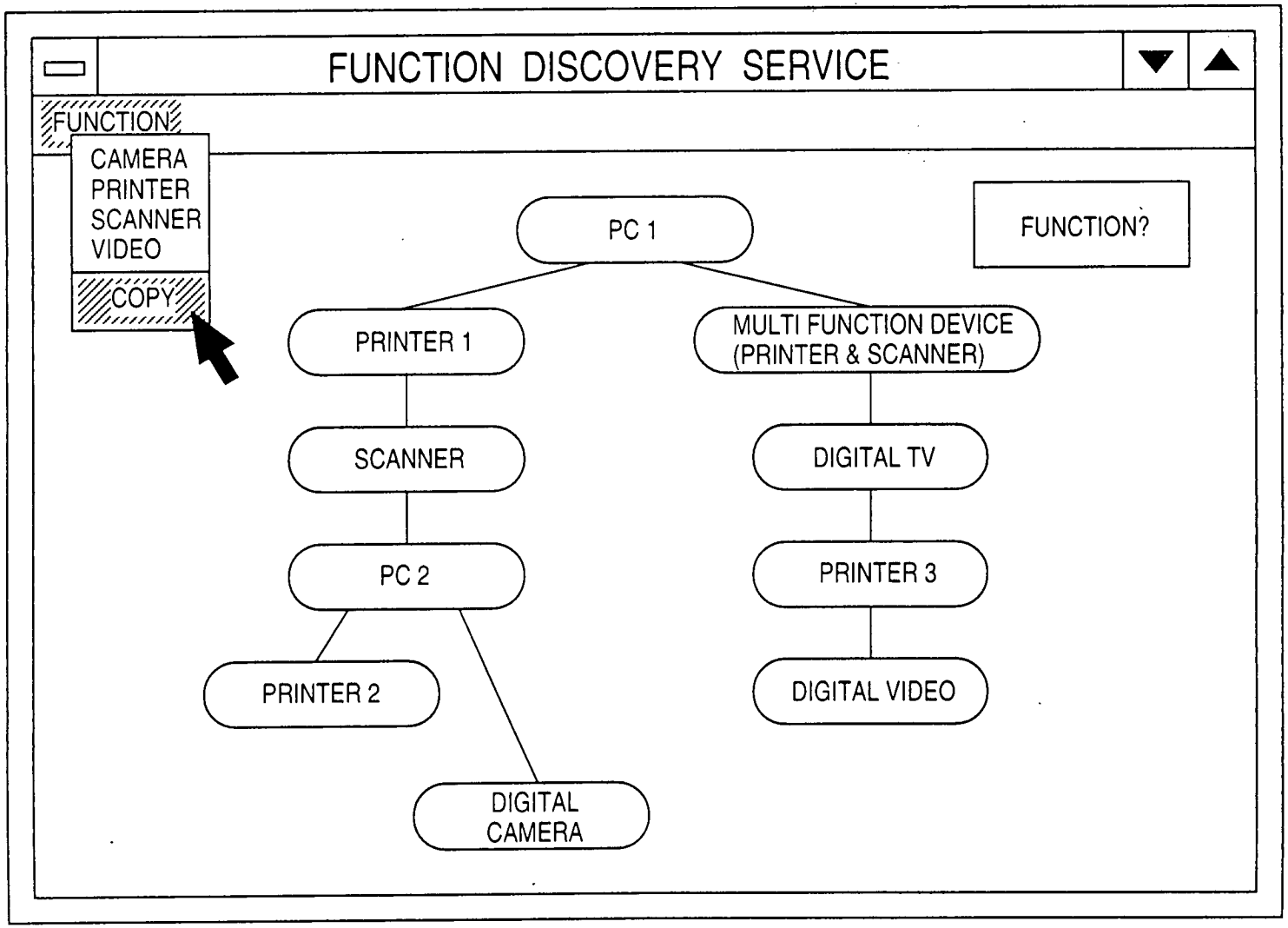

FUNCTION DISCOVERY SERVICE
FUNCTION
CAMERA
PRINTER
SCANNER
VIDEO
COPY
PC 1
FUNCTION?
PRINTER 1
MULTI FUNCTION DEVICE
(PRINTER & SCANNER)
SCANNER
DIGITAL TV
PC 2
PRINTER 3
PRINTER 2
DIGITAL VIDEO
DIGITAL
CAMERA

FIG. 42

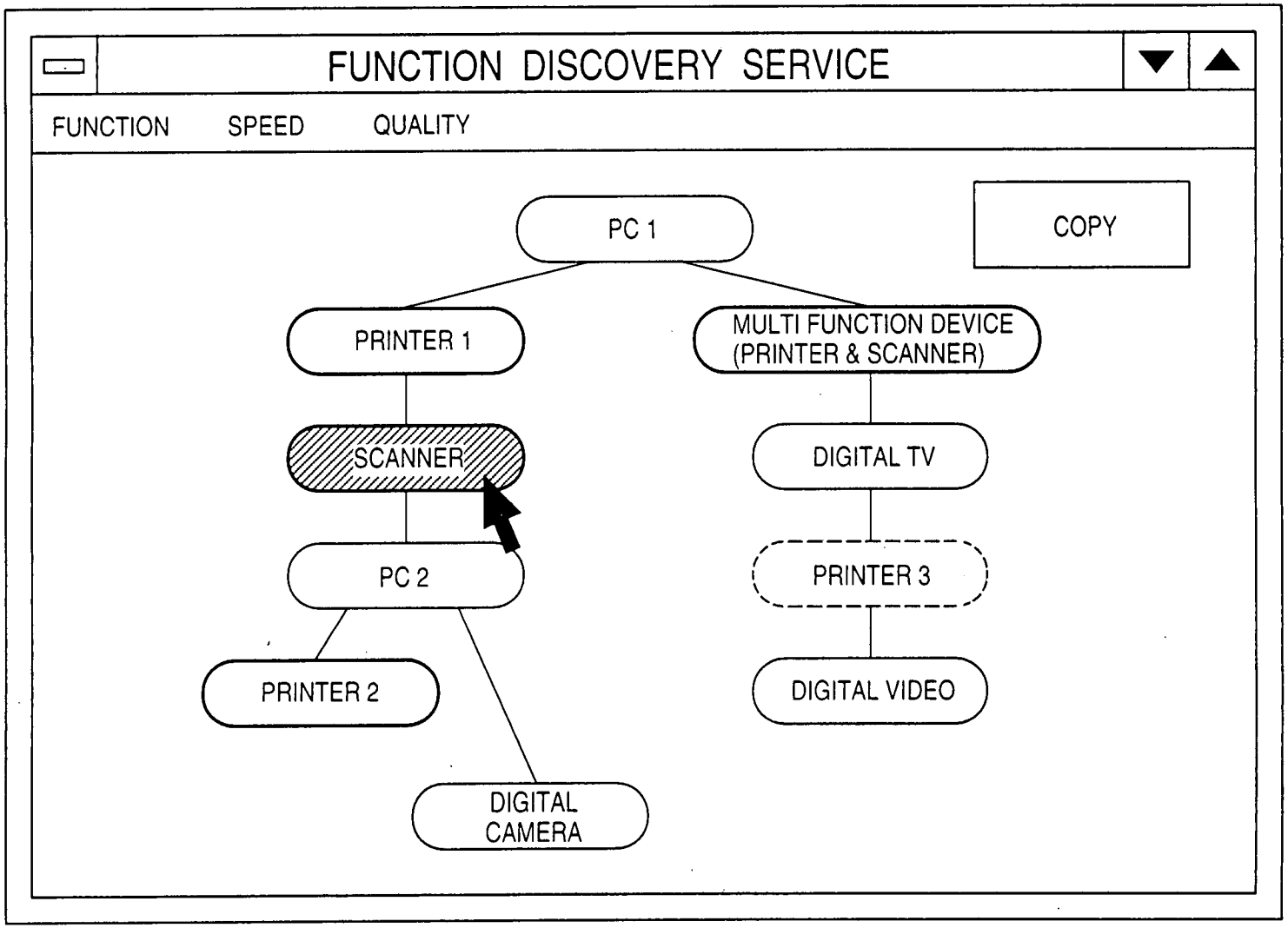
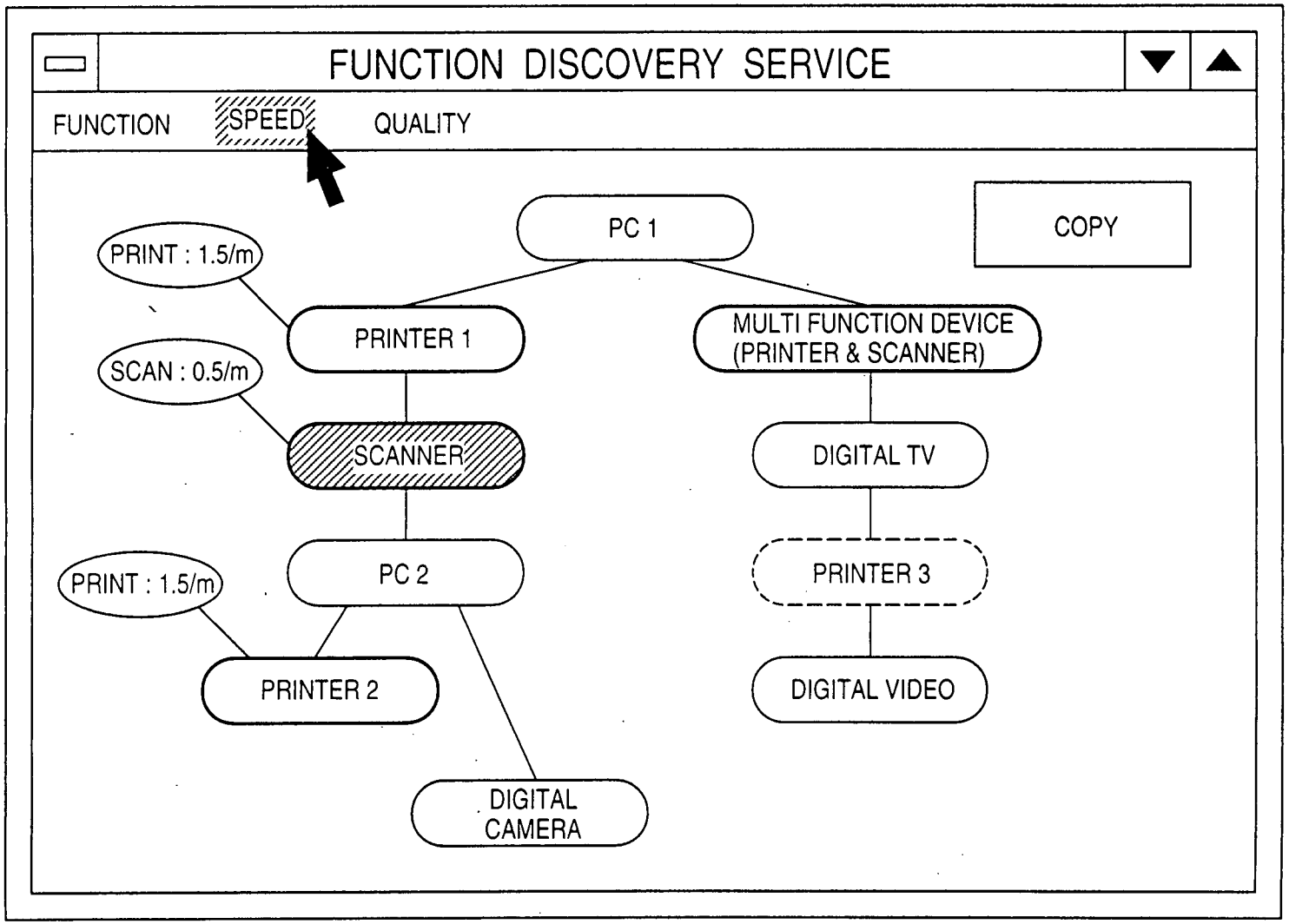
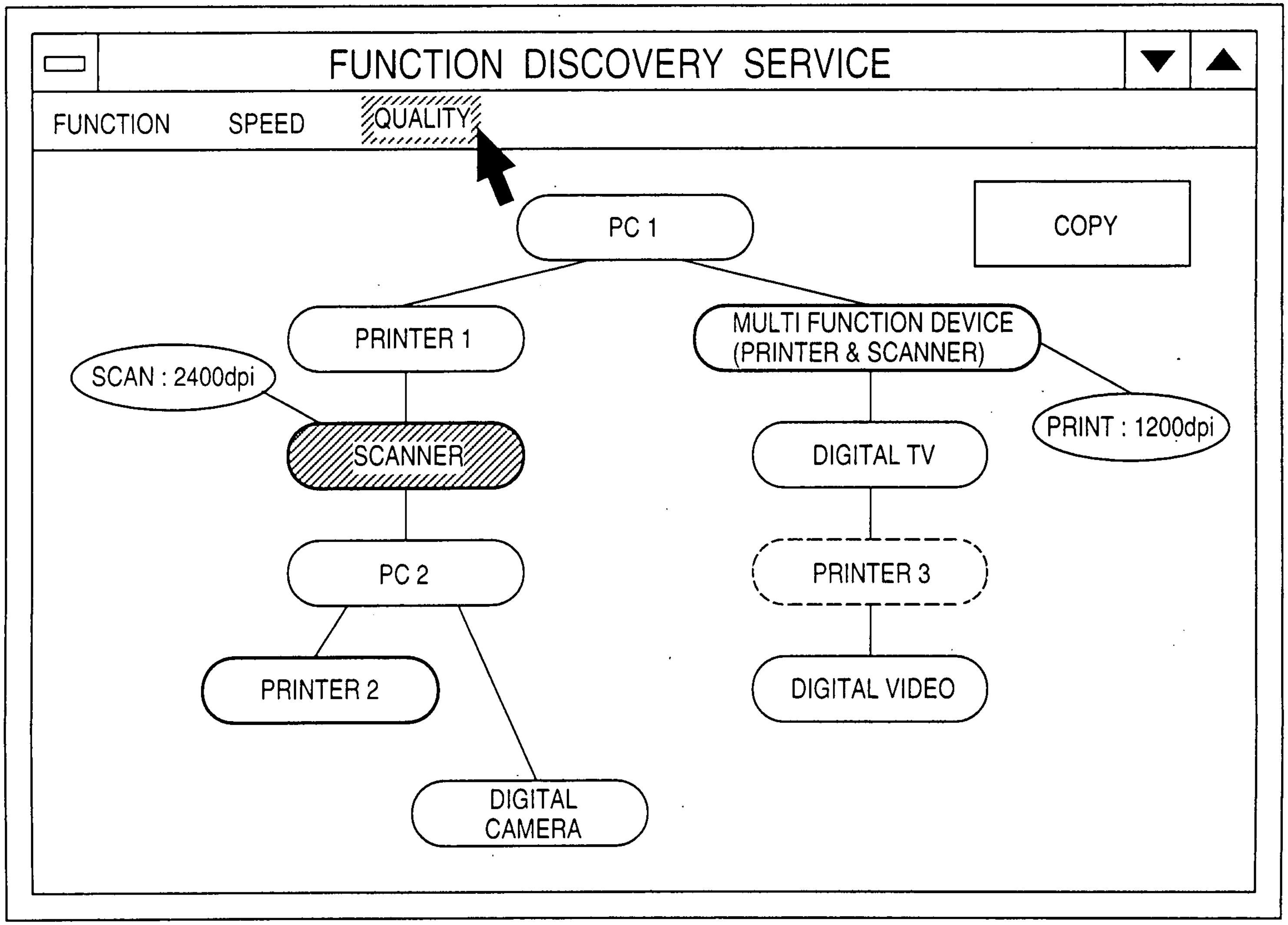

FUNCTION DISCOVERY SERVICE
FUNCTION
SPEED
QUALITY
PC 1
COPY
PRINTER 1
MULTI FUNCTION DEVICE (PRINTER & SCANNER)
SCANNER
DIGITAL TV
PC 2
PRINTER 3
PRINTER 2
DIGITAL VIDEO
DIGITAL CAMERA

FIG. 43


FUNCTION DISCOVERY SERVICE
FUNCTION
SPEED
QUALITY
PC 1
COPY
PRINT : 1.5/m
PRINTER 1
MULTI FUNCTION DEVICE
(PRINTER & SCANNER)
SCAN : 0.5/m
SCANNER
DIGITAL TV
PC 2
PRINTER 3
PRINT : 1.5/m
PRINTER 2
DIGITAL VIDEO
DIGITAL
CAMERA

F I G. 44



FUNCTION DISCOVERY SERVICE
FUNCTION
SPEED
QUALITY
COPY
PC 1
PRINTER 1
SCAN : 2400dpi
SCANNER
PC 2
PRINTER 2
DIGITAL CAMERA
MULTI FUNCTION DEVICE (PRINTER & SCANNER)
PRINT : 1200dpi
DIGITAL TV
PRINTER 3
DIGITAL VIDEO